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ENCYCLOPÆDIA BRITANNICA.

Electricity || Electrometer.

ELECTRICITY, MEDICAL. See MATERIA MEDICA.

ELECTRIDES, anciently iſlands in the Adriatic ſea, which received their name from the quantity of amber (*electrum*) which they produced. They were at the mouth of the Po, according to Apollonius of Rhodes; but ſome hiſtorians doubt of their exiſtence.

ELECTROMETER. In various parts of the article ELECTRICITY, we have deſcribed a great variety of inſtruments for aſcertaining the preſence of electricity, and meaſuring its quantity or proportion.

But there are ſeveral inſtruments of this kind that have not been deſcribed in that article; and as they are well deſerving a place in this work, either from the ingenuity of their conſtruction, the reputation of their inventors, or the intrinſic value of the inſtruments themſelves, we ſhall give an account of them here.

Fig. 1. Plate CC. is a geometrical repreſentation of Mr Cavallo's improved atmoſpherical electrometer, of half its real ſize. The principal part of this inſtrument is a glaſs tube CDMN, cemented at the bottom into the wooden piece AB, by which part the inſtrument is to be held when uſed for the atmoſphere; and it alſo ſerves to ſcrew the inſtrument into its wooden caſe ABO, fig. 2. when it is not to be uſed. The upper part of the tube CDMN, is ſhaped tapering to a ſmaller extremity, which is entirely covered with ſealing-wax, melted by heat, and not diſſolved in ſpirits. Into this tapering part a ſmall tube is cemented, the lower extremity G of which being alſo covered with ſealing wax, projects a ſhort way within the tube CDMN. Into this ſmaller tube a wire is cemented, which with its lower extremity touches the flat piece of ivory H, faſtened to the tube by means of cork; the upper extremity of the wire projects about a quarter of an inch above the tube, and ſcrews into the braſs cap EF, which cap is open at the bottom, and ſerves to defend the waxed part of the inſtrument from the rain, &c. In fig. 3. a ſection of this braſs cap is repreſented, in order to ſhew its internal ſhape, and the manner in which it is ſcrewed to the wire, projecting above the tube L. The ſmall tube L, and the upper extremity of the large tube CDMN, appear like one continued piece, on account of the ſealing-wax, which covers them both. The conical corks P of this electrometer, which by their repulſion ſhow the electricity, &c. are as ſmall as

can conveniently be made, and they are ſuſpended by exceedingly fine ſilver wires. Theſe wires are ſhaped in a ring at the top, by which they hang very looſely on the flat piece of ivory H, which has two holes for that purpoſe. By this method of ſuſpenſion, which is applicable to every ſort of electrometer, the friction is leſſened almoſt to nothing, and thence the inſtrument is ſenſible of a very ſmall degree of electricity. IM, and KN, are two narrow ſlips of tin-foil, ſtuck to the inſide of the glaſs CDMN, and communicating with the wooden bottom AB; they ſerve to convey off that electricity, which, when the corks touch the glaſs, is communicated to it, and being accumulated, might diſturb the free motion of the corks. Electrometer.

In regard to its uſe, this inſtrument may ſerve to obſerve the artificial, as well as the atmoſpherical electricity. When it is to be uſed for artificial electricity, this electrometer is ſet upon a table or other convenient ſupport; then it is electrified by touching the braſs cap EF with an electrified body, which electricity will ſometimes be preſerved for more than an hour. Mr Cavallo had one of theſe electrometers which would remain electrical for more than twelve hours, though in a room without a fire. If in an electrified ſtate, any electrified ſubſtance be brought near the cap EF, the corks of the electrometer, by their converging, or by increaſing their divergency, will ſhew the ſpecies of that body's electricity.

It is neceſſary to remark, that to communicate any electricity to this electrometer, by means of an excited electric, e. g. a piece of ſealing-wax, (which we ſuppoſe is always negatively electrified), is not very readily done in the uſual manner, on account of the cap EF being well rounded, and free from points or ſharp edges. By the approach of the wax, the electrometer will be cauſed to diverge; but as ſoon as the wax is removed, the wires immediately collapſe. The beſt method to electrify it, is to bring the excited wax ſo near the cap, that one or both the corks may touch the ſide of the bottle CDMN; after which, they will ſoon collapſe and appear unelectrified: if now the wax be moved, they will again diverge, and remain electrified poſitively.

When this inſtrument is to be uſed to try the electricity of the fogs, the air, the clouds, &c. the obſerver is to do nothing more than to unſcrew it from its caſe, and, holding it by the bottom AB, to preſent it to the

Electrometer.

open air, a little above his head, ſo that he may conveniently ſee the corks P, which will immediately diverge if there be any ſufficient quantity of electricity; whoſe nature, i. e. whether poſitive or negative, may be aſcertained by bringing an excited piece of ſealing-wax, or other electric, towards the braſs cap EF.

It is perhaps unneceſſary to remark, that this obſervation muſt be made in an open place, as the roads out oftown, the fields, the top of a houſe, &c.

The principal advantages of this electrometer, as ſtated by Mr Cavallo, are as follow.

1. The ſmallneſs of its ſize. Mr Cavallo made one ſo ſmall, that its caſe, which was of braſs, meaſured only three inches and a half in length, and nine tenths of an inch in diameter, and yet it acted perfectly well.

2. Its being always ready for experiments, without fear of entangling the threads, or having an equivocal reſult by the ſluggiſhneſs of its motion.

3. Its not being diſturbed by wind or rain.

4. Its great ſenſibility; and

5. Its keeping the communicated electricity longer than any other electrometer.

II. *Sauſſure's* ELECTROMETER. M. de Sauſſure's electrometer, with which he made the obſervations on atmoſpherical electricity, that have been related in the ſecond chapter of Part V. of the article ELECTRICITY, and is repreſented at fig. 4. is much the ſame with that of Mr Cavallo above deſcribed. The following are the moſt material circumſtances in which they differ: Firſt, the fine wires, by which the balls are ſuſpended, ſhould not be long enough to reach the tin-foil which is paſted on the inſide of the glaſs, becauſe the electricity, when ſtrong, will cauſe them to touch this tin-foil twice conſecutively, and thus deprive them in a moment of their electricity. To prevent this defect, and yet give them a ſufficient degree of motion, it is neceſſary to uſe larger glaſſes than thoſe that are generally applied to Mr Cavallo's electrometer; two or three inches diameter will be found to anſwer the purpoſe very well. But as it is neceſſary to carry off the electricity which may be communicated to the inſide of the glaſs, and thus be confounded with that which belongs to thoſe ſubſtances that are under examination; four pieces of tin-foil ſhould be paſted on the inſide of the glaſs; the balls ſhould not be more than one-twentieth of an inch diameter, ſuſpended by ſilver wires, moving freely in holes nicely rounded. The bottom of the electrometer ſhould be of metal; for this renders it more eaſy to deprive it of any acquired electricity, by touching the bottom and top at the ſame time.

In order to collect a great quantity of electricity from the air, the electrometer is furniſhed with a pointed wire, 15 inches or two feet long, which unſcrews in three or four pieces, to render the inſtrument more portable; ſee fig. 4. When it rains or ſnows, the ſmall parapluie, fig. 5. is to be ſcrewed on the top of the inſtrument, as by this its inſulation is preſerved, notwithſtanding the rain.

This inſtrument indicates not only the electricity of fogs, but that alſo of ſerene weather, and enables us to diſcover the kind of electricity which reigns in the atmoſphere; and to a certain degree, to form an eſtimate of its quantity, and that under two different points of view, the degree of intenſity, and the diſtance from the earth at which it firſt begins to be ſenſible. Electrometer.

A conductor raiſed for the purpoſe of making obſervation on atmoſpherical electricity will be found to exhibit ſigns of electricity, only when the electric fluid is more or leſs condenſed in the air, than in the earth. Though the air reſiſts the paſſage of the electric fluid, it is not abſolutely impermeable to it; it ſuffers it to paſs gradually, and generally with more eaſe in proportion as its maſs or thickneſs is leſs. It is therefore intereſting to diſcover at what height it is neceſſary to be elevated, in order to find a ſenſible difference between the electricity of the earth, and that of the air. A very ſenſible difference may be generally diſcovered by this inſtrument, at the diſtance of four or five feet from the ground; ſometimes it may be ſeen if the inſtrument is placed even on the ground; while at others, it muſt be raiſed ſeven or more feet before the balls will open; ſometimes, though ſeldom, this height is not ſufficient. This diſtance is generally greateſt when the electricity is ſtrongeſt, though neceſſarily modified by a variety of circumſtances, ſome of which are known, as the degree of dryneſs or humidity of the air, and others are unknown.

The degree of intenſity, at a given height, may be diſcovered thus; raiſe the electrometer, and judge by the diviſions which are placed on the edge of it, the degree of their divergence. To find the relation between this degree of divergence, and the force of the electricity, M. de Sauſſure took the following method: As he could not with certainty double or triple a given quantity of electricity; yet as a given force may be reduced one half, a fourth or eighth, &c. by dividing between two equal and ſimilar bodies, the electricity contained in one; he took two of his unarmed electrometers, which were as ſimilar as poſſible, and electrified one of them, ſo that the balls ſeparated preciſely ſix lines; he then touched the top thereof by the top of that which was not electrified; in an inſtant the electricity was equally divided between them, as was evident by the divergence of the balls, which was four lines in each; conſequently a diminution of half the denſity had only leſſened the divergence one-third. One of theſe electrometers was then deprived of its electricity, and was afterwards brought in contact with the other, as before; the remaining electricity divided itſelf again between them, and the balls fell from four to twenty-eight lines, nearly in the ſame proportion as before; in the third operation they fell to nineteen; in the fourth to one, where he was obliged to ſtop, as there was not now ſufficient force in the fluid to paſs from one electrometer to the other, and diſtribute itſelf uniformly between them. The ſame experiment, repeated ſeveral times, gave very nearly the ſame reſults. Negative electricity decreaſed alſo in the ſame proportion as the poſitive. The following table may therefore be conſidered as giving a general, though not exact idea of the increaſe in force, which correſponds to different degrees of divergence in the balls; it is only calculated to every fourth of a line; the force of electricity is always expreſſed by whole numbers, as it would be ridiculous to put a greater degree of exactneſs in the numbers than is to be found in the experiments which form the baſes of the calculation.

Diſtance

Electrometer.	Distance of the balls in fourths of a line.	Corresponding forces of electricity.
1		1
2		2
3		3
4		4
5		5
6		6
7		8
8		10
9		12
10		14
11		17
12		20
13		23
14		26
15		29
16		32
17		36
18		40
19		44
20		48
21		52
22		56
23		60
24		64

Thoſe who are deſirous to carry this meaſure of the electric force further, may do it by having ſimilar electrometers conſtructed, but made upon a larger ſcale, and with heavier balls, which would only ſeparate one line, with the degree of electricity that makes the ſmaller ones diverge ſix lines; theſe would conſequently meaſure a force 1024 times greater than that which forms the unity of the preceding table; and thus by degrees we may be enabled to diſcover the ratio of the ſtrongeſt diſcharge of a great battery, or perhaps even of thunder itſelf, to that of a piece of amber, which only attracts a bit of ſtraw or any other light ſubſtance.

In order to obſerve the electricity of the atmoſphere with this inſtrument, we muſt firſt bring the electric fluid contained in the electrometer to the ſame degree of denſity with that at the ſurface of the earth; this is eaſily done by letting the bottom and top touch the ground at the ſame time; then raiſe the point, keeping the bottom ſtill in contact with the ground, from whence it may be lifted up in a vertical poſition till the balls are level with the eye.

The ſecond circumſtance is to render the divergence of the balls, which is occaſioned by the electricity of the air permanent. This is effected by touching the top of the electrometer with the finger; but here the acquired electricity becomes contrary to that of the body by which they are electrified. Let us ſuppoſe, for example, that the electrometer is at five feet from the ground, and the balls diverging; touch the top of the electrometer with the finger, and the balls will cloſe; but they will again open, if the electrometer is withdrawn from the influence of the electricity of the air, by being brought nearer the ground, or into the houſe. M. Sauſſure only employed this method when the electricity was ſo weak that he could not perceive any untill the electrometer was raiſed conſiderably above his eye: as in this caſe he could not perceive the divergence of the balls, he always endeavoured to obtain a permanent electricity in the foregoing manner. Electrometer.

The following example will render the uſe of the foregoing obſervations more familiar. Chooſe an open ſituation free from trees and houſes, ſcrew the conductor on the top of the electrometer, lay hold of it by its baſe, and place it ſo that the baſe and conductor may touch the ground at the ſame time; then elevate it to the height of the eye, and obſerve the quantity of lines, or fourths of a line, that the balls have diverged; now lower it till the balls almoſt touch each other, and obſerve at what diſtance the top of the conductor is from the ground; and this is the height from the ground at which the electricity of the air begins to be ſenſible. If the electricity of the air is ſufficiently ſtrong to make the balls diverge when it ſtands upon the ground, one of the lengths of the electrometer muſt be unſcrewed from it. If the balls, however, ſtill diverge, the other parts of the conductor ſhould alſo be unſcrewed, and you may mark down, that the electricity is ſenſible at zero, or on the ſurface of the earth. If, on the contrary, the electricity is ſo weak, as not to cauſe the balls to diverge when they are even with the eye, and conſequently when the conductor is two feet higher, or ſeven feet from the ground, you ſhould then raiſe it a foot higher; while it is thus elevated, touch the top with the other hand; when this hand is taken away, lower the electrometer, and if it is electrified, you may ſay the electricity is ſenſible at eight feet; if it is not, raiſe it as high as the arm can reach, and repeat the ſame operation; if any electricity is found, write down electricity ſenſible at nine feet; if not, mark 0, or no electricity relative to this inſtrument, and this mode of employing it; for ſigns of electricity may ſtill be obtained, by throwing a metallic ball 50 or 60 feet into the air, which is at the ſame time connected with the electrometer by a metallic thread.

One advantage of this inſtrument is, that it will often exhibit ſigns of electricity when none can be obtained from a conductor of 100 feet in height, becauſe it can more eaſily be preſerved from humidity, &c. which will deſtroy the inſulation of the large conductors.

This electrometer may be uſed inſtead of the condenſer of M. Volta, by only placing it on a piece of oiled ſilk, ſomewhat larger than the baſe of the inſtrument; but in this caſe, it is the baſe, and not the top of the inſtrument, which muſt be brought into contact with the ſubſtance whoſe electricity is to be explored.

It is eaſy to diſcover alſo by this inſtrument, the electricity of any ſubſtance, as of cloths, hair of different animals, &c. For this purpoſe, it muſt be held by the baſe, and the ſubſtance rubbed briſkly (only once) by the ball of the electrometer; the kind of electricity may be aſcertained in the uſual manner. It is proper, however, to obſerve here, that as the top of the electrometer acts in this caſe as an inſulated rubber, the electricity it acquires is always contrary to that of the rubbed body.

III. *Cadet's* ELECTROMETER, is thus deſcribed by the author, as tranſlated in Nicholſon's Journal.

Fig. 6. In a glaſs tube A, 18 or 20 inches long, is incloſed another ſhorter tube X, ſealed at both ends. This tube contains a graduated ſcale: one of the ends of theſe two tubes is cemented in a handle of turned

Electrometer. wood, C, by which it is held in the hand; the other end is closed by a brass cap, D; the distance between the extremities of the small tube and that of the large one is filled with red wax, B, B; on the cap D is screwed at pleasure, either a ring E, or a brass hook F. The ring is used for applying the instrument to the ball of a conductor, and the hook when it is hung to a ring: on the cap D is a brass stem G, terminating by a knob. This stem is bended, and the extremity of its knob must be directly beneath the line with which the graduated scale of the small tube commences.

Round the large tube is a brass ring H, half of which extends to the length of twelve or fifteen lines, in the form of a half tube P, applied against the sides of the tube. This gutter serves to mark the degrees, by sliding along the graduated scale by means of a button beneath I. On the ring H is fixed one of the small electrometers invented by Sauſſure, K, K, which is surmounted by a stem V, on which stem is fixed at pleasure either a point L, or a ball M, of the same size as that which terminates the stem G, opposite which it is placed. The extremity of this point or ball must be placed immediately over the extremity of the half tube or scale P, and horizontally to the centre of the ball, which terminates the stem G.

At the top of Sauſſure's electrometer is a small ring N, which serves to connect it with the chain Z when required.

To explain the use of this instrument by a single experiment, charge a Leyden jar, till the spontaneous overflowing announces it to be saturated. Then place the ring E on the knob of this bottle, and cause the electrometer of Sauſſure, armed with its point, to slide towards it. Observe the degree at which the divergence of the thread stream commences, and at that instant suppress the point, and adapt in its place the ball M. Continue to advance the electrometer of Sauſſure till the electric pressure of the atmosphere in the jar causes the threads to diverge; again observe the degrees, replace the point L, and close the shutters of the room; then continue to advance the electrometer till the luminous point appears, which again affords new degrees. Lastly, replace the ball M, and fix the chain Z to the small ring N; cause it to communicate with the exterior coating of the jar, and advance the electrometer till the explosion takes place. Then comparing the different degrees, we may ascertain the comparative difference between the respective methods.

As soon as these relative proportions have been once accurately ascertained by attentive observations, one of those methods alone will be sufficient for measuring the intensity of electricity; and, in fact, if the body intended to be submitted to examination be little charged with the electric fluid, the diverging of the threads, by means of the point, will fix the limits of the electric atmosphere: if it be more, the pressure of the atmosphere on the ball M, which is substituted for the point, will indicate this quantity. In short, if the body be loaded with a considerable mass of electric matter, it will be shown by the luminous point. If a Leyden jar, instead of being positively, is negatively electrified, the point indicates it at the same time that it measures the electric atmosphere, for instead of a luminous point, a star will be observed upon the ball of the jar, and another at the end of the point. Electrometer.

Let us now apply this electrometer to useful observations,

In order to connect the idea of a determinate quantity of fluid to each degree of the electrometer, it is necessary to compare these degrees with the known quantities. Suppose for instance we have a jar, the coating of which is six inches square; electrify it till a spontaneous discharge takes place, and remark, by means of Henly's electrometer, at what degree this discharge is effected. Again, electrify the jar, till it is nearly saturated, and measuring with this electrometer, observe, that the luminous point appears for instance at two degrees; then say, that when the electrometer, applied to an electrified body, marks two degrees, the body contains six inches square of electricity. Repeat this experiment with a plate of glass, the coating of which is seven, eight, ten, or twelve square inches, and we may form a scale of proportion, which is of the greatest utility in accurate experiments.

"In endeavouring to ascertain some of these propositions, (says M. Cadet), I have made an observation which has convinced me of the utility of my electrometer in discovering the capacity of electric apparatus. Having taken a jar from an electric battery, I electrified it, and measured it with a point which I passed along a string of silk; on observing the distance at which the luminous point appeared, I joined this jar to another of the same size, and imagined that by doubling the quantity of matter, the measure I had taken would also be doubled; on the contrary, however, the latter measure was not more than about one-third of the former: I then added a third bottle; and still obtained nearly the same result; whence the following proposition appears to be established; namely, that the extent of the electric atmosphere is in an inverse ratio to the quantity of fluid accumulated. Another observation which I have several times made, on measuring the electric atmosphere of a conductor, is, that the limits of this atmosphere form an elliptic figure around the body, nearly similar to that represented at fig. 7.

"This doubtless arises from the electrified body suspended in a chamber, being nearer to the earth than the ceiling; but it would be a curious experiment to measure it at an equal distance from every attracting body, in order to observe whether the fluid has not really a tendency to descend towards the earth, rather than in any other direction. It is my intention to repeat this experiment, as I consider it of great importance to ascertain whether electricity gravitates towards the globe.

"From these first attempts, I conceive my electrometer would be well adapted for measuring the absolute capacity of Leyden jars, and also their capacity with regard to their size, or to the quality of the glass of which they are constructed; for the latter, by its greater or less density, absorbs a greater or less quantity of fluid."

IV. *Lawſon's* ELECTROMETER. This is a simplified improvement on Brooke's steelyard electrometer, and should have been described when that instrument was mentioned, instead of Mr Adams's; but it did not occur to us till after that sheet was printed.

The

Electrometer.

The following account is given of this electrometer, in a letter from Mr Lawſon to the editor of the Philoſophical Magazine.

"Some time ago it ſtruck me that ſome additions to Brooke's electrometer might be made, ſo as to fit it for a good diſcharging electrometer to meaſure the repulſion between two balls (of a certain ſize) in grains, and alſo effect the diſcharge of a battery at the ſame time. The inſtrument known by the name of Cuthbertſon's diſcharging electrometer, (See ELECTRICITY, N° 203.) was at that time the beſt, and indeed the only inſtrument for diſcharging batteries or jars by its own action, then made; but I think this will be found, in the eſſentials, and in the theory and uſe, a more perfect inſtrument.

"On the baſis (fig. 8.) is fixed the glaſs pillar G, ſupporting the hollow braſs ball B. I is a light graduated braſs tube, divided (from the weight W towards the ball B) into thirty parts, repreſenting grains. W is a ſliding weight. L, a light braſs ball ſcrewed to the end of the tube I. On the other end of which tube adjuſts the heavy counter-balance ball C, the tube I and its two balls being ſuſpended at their common centre of gravity by a ſilk line in the centre of the ball B, the mechaniſm of which is ſhewn in fig. 9. The braſs ball F is ſtationary, and of the ſame ſize as the ball L; and is fixed by, and adjuſts cloſe to, the ball L, or at any lower ſtation between that and the ring *r*. The braſs tube to which the ball A is fixed is divided into inches, halves, and quarters: (a more minute diviſion is unneceſſary and improper). The diviſions begin, or the line o is marked on the ſaid tube at the ring *r*, when the three balls A, L, F, are cloſe together. The ring *r* ſerves as an index, as the diviſions paſs in ſucceſſion into the glaſs tube P on lowering the ball A. The hook H is ſcrewed into the baſe of P. The quadrant, or Henly's electrometer, Q, is ſupported in a long braſs ſtem, to keep it out of the atmoſphere of the lower part of the inſtrument. Fig. 9. ſhows the internal conſtruction of the ball B, fig. 8. In the firſt place the ball ſcrews in half, horizontally. The light tube I paſſes through the ball, and is ſuſpended nearly in the centre of it by ſome ſilk twiſt, *s*, which ſmall ſilk twiſt is fixed into the eye of the adjuſting wire, *a*, part of which wire is filed ſquare and goes through the ſquare hole *b*. The nut *n* ſcrews on *a*, and ſerves to adjuſt the light tube I vertically. The light plates PP are of copper, and move freely on the wire *w w* ſomewhat like a hinge, and reſt on the copper wires CC, ſerving to make the direct communication between the inſide and out of the battery or jar. NN are notches ſerving to let the tube I deſcend when the diſcharge is made. Into the tube Z the glaſs pillar is ground. Note, that at the bottom of the notch N is a piece of braſs filled with a Y, and ſo placed as to keep the centres of the balls L and F, fig. 8. under each other when they come cloſe together.

"When the inſtrument is adjuſted, which is done by placing the weight W, fig 8. at o on the line of grains, and then ſcrewing or unſcrewing the counterbalance ball C, till the tube I riſes ſlowly into its horizontal poſition; then ſet the ball A at the diſtance from the ball L that you chooſe, and the weight W placed at the diviſion or number of grains that you wiſh the repulſive power of the electricity to arrive at before the diſcharge is made: this being done, connect the battery or jar with the ball B, by means of the wire *y*, the end of which goes into B at the hole X, and ſhould ſtand at right angles to B, the ball of *y* reſting on the battery: then connect the outſide of the battery or jar with the hook H. As the battery charges, the electrometer Q continues to riſe; and when it is ſo highly charged that the repulſive power between the balls L and F is equal to the number of grains at which the weight W was placed, the ball L will deſcend, and deliver the charge of the battery to the ball A. The ſubſtance or thing through which the ſhock is intended to be paſſed, muſt form part of the communication between the hook H and the outſide of the battery or jar."

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V. *Hauch's* ELECTROMETER. Fig. 10. contains a repreſentation of this electrometer, and the different parts of which it conſiſts. OP is a board of dry mahogany, twelve inches in length and four in breadth, which ſerves as a ſtand for the inſtrument. In this board are faſtened two maſſy glaſs pillars, M and N, which ſupport the two braſs caps or rings GG, with the two forks of tempered ſteel KK ſcrewed into them. The two rings GG are well covered with varniſh.

In the ring is faſtened a braſs rod, which terminates in a ball E of the ſame metal, and an inch in diameter. The length of the rod and ball together is four inches and a half.

A very delicate beam AB, the arms of which are of unequal length, moves on a ſharp triangular axis (a knife edge) of well tempered ſteel, on the fork K of the pillar M. It is ſeventeen inches in length, and ſo conſtructed that the ſhort arm forms a third, and the long one two-thirds of the whole beam. The ſhort arm of braſs furniſhed with the ball B, exactly of the ſame ſize as the ball E, is divided into forty five parts-equivalent to grains. The long arm A is of glaſs covered with copal varniſh, and ends in an ivory ball A, into which is fitted an ivory hook R, deſtined to ſupport the ivory ſcale H. In order to render the inſulation more complete, this ſcale is ſuſpended by three hairs.

A very delicate beam CD, eleven inches in length, moves on an axis like the former, on the pillar N, though not here ſhewn. This beam is proportioned in the ſame manner, one arm being a third and the other two thirds of the whole length. The long arm of braſs is furniſhed at the end with a ball D, and divided into thirty parts correſponding to grains. The ſhort arm of glaſs terminates in a long roundiſh plate C, covered with copal varniſh. The ſteel forks are ſhewn by the ſections of the two braſs caps FF, as are alſo the two knife edges L, L. By theſe caps the eſcape of the electric matter is partly prevented.

A braſs ring Q, capable of being moved along the ſhort arm of the upper beam AB, ſhews by means of marks determined by trial and cut out on the beam, the number of grains which muſt be placed in the ſmall ſcale to reſtore the equilibrium of the beam, at each diſtance of the ring Q from the point of ſuſpenſion.

On the long arm CD of the lower beam there is alſo a moveable ring S, which, like the ring Q, ſhews in grains, by its diſtance from the point of ſuſpenſion, the power requiſite to overcome the preponderance of LD in regard to LC.

The power neceſſary for this purpoſe will be found, if the

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the ſhell H, which weighs exactly fourteen grains, be ſuffered to ſink down on the glaſs plate C, and the ring *s* be puſhed forwards till both the arms of the beam are in equilibrium. The part of the beam on which the ring *s* has moved, is divided into fourteen parts, ſo that 0 marks the place where the ring *s* muſt ſtand when the beam, in its free ſtate, is in equilibrium; and 14 ſtands at the place where the ring *s* again reſtores a perfect equilibrium when the ſhell H is laid on the glaſs plate C. Each of theſe parts, which are divided into quarters, indicates a grain. The lower diviſions of the ſcale will be found with more accuracy, if quarters of a grain be put, in ſucceſſion, into the ſhell H (after it has been laid on the plate C), and the ring *s* be moved between each quarter of a grain until the perfect equilibrium be reſtored. This place on the beam is then to be marked, and you may continue in this manner until the 30th part of a grain be given. Both ſcales, for the ſake of diſtinctneſs, are divided only ſo low as quarters of a grain; though the inſtrument is ſo delicate, and muſt abſolutely be ſo, that 1-20th of a grain is ſufficient to deſtroy the equilibrium.

The two glaſs pillars M and N, together with the ſteel forks affixed to them, are ſo fitted into the ſtand that both the beams lie parallel to each other as well as to the rod GE. In this poſition of the beams AB, the balls B and E are juſt in contact. The ſmalleſt glaſs pillar N is of ſuch a height that the ball of the beam CD ſtands at the diſtance of exactly four lines from the ring G, and cannot move without touching the latter. The ſmall ſhell H is ſuſpended in ſuch a manner that there is a diſtance of exactly two lines between it and the ſhell C. In each of the braſs rings GG is a ſmall hole, that the inſtrument may be connected with the two ſides of an electric jar. I is a braſs wire, with a hollow bit of ivory, *a*, deſtined to ſupport the beam CD, which is neceſſarily preponderate at D, in order to prevent oſcillation between the diſcharges to be examined by the inſtrument.

It may be readily comprehended that, when the beam AB has moved, A muſt paſs over twice the ſpace that B does; and that in the beam CD, the caſe is the ſame in regard to C and D. If AB be therefore connected with the external, and CD with the internal ſide of a battery, but in ſuch a manner that the inſtrument is at a ſufficient diſtance beyond the electric atmoſphere; and if the battery be charged, the repulſive effect of the electric power will oblige the ball B to ſeparate from the ball E; the ſhell L muſt therefore naturally ſink down with double velocity, ſo that when the ball B riſes a line, the ſhell H muſt ſink two: when it reaches this depth it will touch the ſhell C, and the latter, by the power excited in it, will be obliged to ſink, by which D muſt naturally again aſcend in a double proportion to the ſinking of C; ſo that when C has fallen two lines, D muſt have aſcended four, and D that moment touches the ring by which the two ſides of the battery are connected with each other, and diſcharges the battery.

But as the attractive electric power between unlike atmoſpheres, under like circumſtances, is at leaſt as ſtrong as its repulſive power between like atmoſpheres, it would thence follow, that the electric power, inſtead of repelling the ball B from the ball E, would rather attract D, and by its contact with G, promote the diſcharging; by which the inſtrument would fail of its object, and be ſubjected to the temperature of the atmoſphere like all other electrometers; and, beſides this, the electric power could no longer be determined by weight. To obviate this inconvenience, the inſtrument, in all electrical experiments, muſt be applied in ſuch a manner that the power with which the ball D is attracted by AB may exceed in ſtrength the power required to repel the ball B from the ball E. For this purpoſe the ring *s* muſt always be removed two diviſions farther on CD, towards D, than the ring Q is ſhifted on AB towards B. If, for example, an electric force were required equal to eight grains, according to this electrometer, the ring Q muſt be removed to the place where 8 ſtands, and the ring *s* to the place marked 10. The repulſive power will then naturally repel the balls B and E before G is in a condition to attract the ball D, as a power of two grains would be neceſſary for this purpoſe, beſides that of the eight already in action. The ſhell H with its weight of fourteen grains, will eaſily overcome the preponderance of LD or LC, as it amounts only to ten grains, and therefore nothing exiſts that can impede the diſcharging.

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When the ring 1, according to the required power, is removed ſo far towards D, that the ſhell H is not able by its weight to deſtroy the preponderance of LD in regard to LC, the active power of the ſhell H muſt be ſo far increaſed by the addition of weights, that it can act with a preponderance of four grains on the plate C. If, for example, an electric power of 14 grains be required, the ring 1 muſt be removed to 16, by which LD reſts upon *a*, with a preponderance of 16 grains in regard to LC. Now, to make H act on the plate C with a preponderance of four grains, it muſt be increaſed to 20 grains, that is, ſix grains weight more muſt be added, as it weighs only 14; which ſix grains are again laid upon LB; and therefore the ring Q is ſhifted to 20, as the ſtrength of the repulſive power is pointed out by 14 grains.

If an electric power of 25 grains be required, the ring *s* muſt be removed to 27, and the weight of 17 grains be put into the ſhell H, in order to produce a preponderance of four grains in regard to *s*. Theſe 17 grains are added to the required power of 25 grains, and the ring Q is puſhed to 42, &c. In this manner the repulſive power always acts before the attractive power can.

It may be readily perceived that the faults and inconveniences common to all the electrometers hitherto employed, and which have been already mentioned, cannot take place here; becauſe the diſcharging is performed by immediate connection between the poſitive and negative electricity in the inſtrument itſelf, without any external means being employed.

One of the moſt eſſential advantages of this inſtrument is, the certainty with which the ſame reſult may be expected when the experiment is repeated. From the ſame degree of electric power, whatever be the temperature of the atmoſphere, it will always be neceſſary to commence the ſeparation of the two balls B and E from each other, the quantity of coated glaſs and the diſtance of the ring Q from the axis L being the ſame.

Another no leſs important advantage of this inſtrument is, that in an experiment where the ſame electric

power,

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power, often repeated, is neceſſary to aſcertain the reſult with accuracy; ſuch, for example, as the charging a battery through acids, water, &c.; the ſame degree of precaution is not neceſſary as is indiſpenſibly ſo in any other electrometer, as the perſon who puts the machine in motion has nothing to do but to count how often the electrometer diſcharges itſelf; and the inſtrument may be incloſed in a glaſs caſe, or prevented in any other manner from external contact, or any other circumſtances which might render the experiment uncertain.

"I flatter myſelf (ſays M. Hauch), that the ſimplicity of the conſtruction of this inſtrument, the facility with which it may be made at a very ſmall expence, and the certainty that two inſtruments, prepared according to the ſame ſcale, with a like quantity of coated glaſs, muſt exactly correſpond with each other, but above all, that the certainty and accuracy by which experiments may be made with it, and by theſe means be accurately deſcribed, are advantages which will not be found united in any of the electrometers hitherto invented*".

* *Phil. Magaz.* vol. iv.

We ſhall cloſe this account of electrometers with deſcribing the conſtruction and uſe of M. Coulomb's electrometer, or, as he calls it, *Electrical Balance*.

ABDC (fig. 11.) repreſents a glaſs cylinder, twelve inches in diameter and the ſame in height, covered by a glaſs plate fitted to it by a projecting fillet on the under ſurface. This cover is pierced with two round holes one inch and three fourths in diameter. One of them *f* is in the centre, and receives the lower end of the glaſs tube *fh*, of twenty four inches height, which is fixed in the hole with a cement made of ſealing-wax, or other electric ſubſtance. The top of this tube receives the braſs collar H, (fig. 12. N° 3.) bored truly cylindrical with a ſmall ſhoulder, which reſts on the top of the tube. This collar is faſtened with cement, and receives the hollow cylinder φ (fig. 12. N° 2.), to which is joined the circular plate *a b*, divided on the edge into 360 degrees. It is alſo pierced with a round hole G in the centre, which receives the cylindrical pin *i* (fig. 12. N° 1.) having a milled head *b*, and furniſhed with an index *i o*, whoſe point is bent down ſo as to mark the diviſions on the circle *a b*. This pin turns ſtifly in the hole G, and the cylinder φ moves ſteadily in the collar H. To the lower end of the centre pin is faſtened a little pincer, *q*, formed like the end of a port-crayon, and tightened by the ring *q*, ſo as to hold faſt the ſuſpenſion wire, the lower end of which is graſped by a ſimilar pincer, P *o* (fig. 13.) tightened by the ring φ. The lower end φ *o* is cylindrical, and is of ſuch a weight, as to draw the wire perfectly ſtraight, but without any riſk of breaking it. It may be made equal to half of the weight that will juſt break it.

This pincer is enlarged at C, and pierced with a hole, which tightly receives the arm *g* C *q* of the electrometer. This arm is eight inches long; and conſiſts of a dry ſilk thread, or a ſlender ſtraw completely dried, and dipped in melted lac or fine ſealing wax, and held perpendicularly before a clear fire, till it become a ſlender cylinder of about one tenth of an inch in diameter. This occupies ſix of the eight inches, from *g* to *q*: the remaining two inches conſiſt of a fine thread of the lac or ſealing-wax, as it drains off in forming the arm. At *a*, is a ball of pith or fine cork, one-fourth or one-half of an inch in diameter, made very ſmooth, and gilded. It is balanced by a vertical circle of paper *g*, of large dimenſions, made ſtiff with varniſh. The reſiſtance of the air to this plane ſoon checks the oſcillations of the arm. Electrometer.

The whole inſtrument is ſeen in its place in fig. 11. where the arm hangs horizontally about the middle of the height of the great cylinder. In its oſcillations the ball *a* moves round in a circle, whoſe centre is in the axis of the whole inſtrument. Its ſituation is indicated by a graduated circle $\approx o q$, drawn on a ſlip of paper, and made to adhere to the glaſs by varniſh. The electrified body whoſe action is to be obſerved, is another ſmall ball of cork *t*, alſo gilt, or a braſs ball well poliſhed. This is carried by a ſtalk of lac *m* φ, incloſing a dry ſilk thread. This ſtalk is graſped by a clamp of cleft deal, or any ſimilar contrivance, which is made to lie firm on the glaſs cover. When this ball is let down through the hole *m*, it ſtands ſo as to touch the ball *a* on the arm, when that ball is oppoſite to o on the graduated circle.

In order to electrify the ball *t*, we are to employ the inſulating handle, fig. 14. which is a ſlender ſtick of ſealing-wax or lac, holding a metal wire that carries a ſmall poliſhed metallic ball. This is to be touched with ſome electrified body, ſuch as the prime conductor of a machine, the knob of a jar, &c. This electrified ball is to be introduced cautiouſly into the hole *m*, and the ball *t* is to be touched with it. The ball *a* is immediately repelled to a diſtance, twiſting the ſuſpenſion wire, till the force of twiſt exerted by the wire balances the mutual repulſion of the balls *t* and *a*.

This is the proceſs for examining the law of electric action. When it is deſired to examine the action of different bodies in different ſtates, another apparatus is wanted. This is repreſented by the piece *c* A *d* (fig. 15.) conſiſting of a plug of ſealing-wax A, fitting tightly into the hole *m*, and pierced by the wire *c d*, hooked at *c*, to receive a wire to connect it occaſionally with an electrified body, and having below a poliſhed metal ball *d*.

The inſtrument is fitted for obſervation in the following manner: The milled button *b* is turned at top, till the twiſt index *i o* is at the mark o of the twiſt circle. Then the whole is turned in the collar H, till the ball *a* ſtand oppoſite to the mark o of the paper circle $\approx o$ Q, and at the ſame time the ball *t* or *d* is touched. The obſervation is thus made. The ball *t* is firſt electrified, as juſt deſcribed, and thus *a* is repelled, and retiring twiſts the wire, ſettling, after a few oſcillations, at ſuch a diſtance as is proportional to the repulſion. The twiſt-index is now turned ſo as to force *a* nearer to *t*. The repulſion thus produced is eſtimated by adding the motion of the index to the angle at which the ball firſt ſtopped. Giving the index another, we have another repulſion, which is eſtimated in a ſimilar way, and thus we obtain as many meaſures as required.

It is not neceſſary to make this inſtrument of very large dimenſions; one 14 inches high, and five in diameter, of which the arm *a g* ſhould occupy two inches and an half, will be ſufficiently large for moſt purpoſes. The diameter of the glaſs cylinder muſt always be double the length of the arm *a g*, that the poſition of this may not be diſturbed by the action of the glaſs.

Dr Robiſon conſidered this electrometer as one of the

Electrometer. the moſt valuable inſtruments that have been made, as it is not only extremely delicate, but gives abſolute meaſures with the greateſt accuracy. For all purpoſes in which only repulſions were to be meaſured, he preferred it to his own inſtrument deſcribed in ELECTRICITY, N° 206.

He, however ſuggeſted ſeveral improvements in it, which are deſerving of attention.

The bottom ſhould be furniſhed with a round hole, admitting the lower end of the cylinder C *c* belonging to the lower pincer (when the wire is ſtrained at both ends) to hang freely, by which means much tedious oſcillation will be prevented. It is much more convenient to have the ſuſpenſion wire ſtrained at both ends; and it ſhould extend as far below the arm as above it, and the lower extremity ſhould be graſped by a pincer that turns by a milled head in a hole at the end of a ſlender ſpring. The inſtrument may then be ſpeedily adjuſted by placing the twiſt index at o, and gently turning the lower button till the ball *a* point exactly at o on the paper circle.

The inſtrument will be greatly improved, if, in place of the apparatus with the ball *t*, we ſubſtitute the piece repreſented at fig. 15. making ſome little changes in its conſtruction. Thus, inſtead of the wire *c d*, is uſed the ſmalleſt glaſs tube that will admit of being varniſhed on the inſide, which is done by drawing through it a ſilk thread dipped in varniſh, made of lac.

The outſide of the tube muſt alſo be varniſhed, and a braſs ball *d* fixed at its lower end, and a ſlender wire, ſurmounted by a ball, is to be inſerted into the tube, ſo as to touch the ball below. The poſition of the ball *d* will not be liable to alteration, when the hole *m* is once ſtopped with the plug. In making delicate experiments, the upper ball *c*, muſt be touched with the charger, repreſented at fig. 14. by which means the ball *d* is electrified. Then drawing out C by means of the forceps, the ball *d* is left completely inſulated. In examining the electricity of the atmoſphere, to which purpoſe this inſtrument is well adapted, the wire muſt be allowed to remain in the tube.

It was by means of this incomparable inſtrument, that M. Coulomb made the valuable experiments, to which we alluded in the article ELECTRICITY, when treating of the law of action of the electric fluid. By means of this electrometer, he alſo made his experiments on the diſſipation of electricity into the air, and along imperfect conductors. He aſcertained the law of diſſipation into the air from bodies in contact, and the relation which this bore to the original repulſion, by firſt obſerving the gradual approach of the ball *a* towards *t*, in proportion as the electricity diſſipated from both, and then ſlackening the twiſt index till the ball *a* reſumed its original ſituation.

The following was the general reſult of Mr Coulomb's experiments.

That the momentary diſſipation of moderate degrees of electricity is proportional to the degree of electricity at the moment. He found that the diſſipation is not ſenſibly affected by the ſtate of the barometer or thermometer; nor is there any ſenſible difference of bodies of different ſizes or different ſubſtances, or even different figures, provided that the electricity is very weak.

But he found that the diſſipation was greatly affected by the different ſtates of humidity of the air. In the Electrometer. ſcale of Sauſſure's hygrometer, the relation to the quantity of water which a cubic foot of air is capable of holding in ſolution is diſtinctly marked; the relation of this ſolution to the diſſipation of electricity in Coulomb's experiments may hence be ſeen in the following table, the firſt column of which marks the degrees of Sauſſure's hygrometer, the ſecond how many grains of water are diſſolved in a cubic foot of air at each degree, and the third column ſhews the correſponding diſſipation per minute.

69	6,197	$\frac{1}{60}$
75	7,295	$\frac{1}{41}$
80	8,045	$\frac{1}{29}$
87	9,221	$\frac{1}{14}$

Hence it follows, that the diſſipation is very nearly in the triplicate ration of the moiſture of the air. Thus if we make $\frac{60}{41} = \left|\frac{7,197}{6,180}\right|^m$; *m* will be = 2,764. If we make $\frac{60}{29} = \left|\frac{8,045}{6,180}\right|^m$; *m* will be = 2,76; and if we make $\frac{60}{14} = \left|\frac{9,240}{6,180}\right|^m$; *m* will be = 3,61; or at a medium *m* will be = 3,40.

The immediate object, that M. Coulomb had in view in his experiments, was to aſcertain the diminution of repulſion. He found that this, in a given ſtate of the air, was a certain proportion of the whole repulſion taken at the moment of diminution, which is double the proportion of the denſity of the fluid; for the repulſions by which we judge of the diſſipation are reciprocal, being exerted by every particle of fluid in the ball *t* of the electrometer, on every particle of fluid in the ball *a*. The diminution of repulſion is therefore proportional to the denſity of the electric fluid in each ball; and, as during the whole diſſipation, the denſities continue to have their original proportion, and as the diminution of repulſion is directly proportional to the diminution of the products of the denſities, it is conſequently directly proportional to the ſquare of either. If we put *d* for the denſity, the mutual repulſion will be repreſented by d^2, and its momentary diminution by the fluxion of d^2, or $2\,d\,\dot{d} = 2\,d \times \dot{d}$. But $2\,d \times \dot{d} : d^2 = 2\,\dot{d} : d$. The diminution of repulſion obſerved by experiment will be to the whole repulſion, in double the proportion that the diminution of denſity, or the diſſipation of fluid will have to the whole quantity of fluid at the moment of obſervation. Let us, for inſtance, ſuppoſe the obſerved diminution of repulſion to be $\frac{1}{40}$; we may conclude, that the quantity of fluid loſt by diſſipation is $\frac{1}{80}$. M. Coulomb did not examine the proportion of the diſſipations from bodies of various ſizes. But we know, that if two ſpheres communicate by a very long canal, their ſuperficial denſities, and the tendencies of fluid to eſcape from them, are inverſely as the diameters of the ſpheres. Now, in a body that has twice the diameter of another body, the ſurface of the former is quadruple of that of the latter; and though the tendency of fluid to eſcape from the former is only the half of its tendency to eſcape from the latter, yet the greater ſurface of the former may ſo far make up for its ſmaller denſity, that the

Electrometer.

the diſſipation of fluid from a large ſphere may in fact be greater than that from a ſmall one in the ſame given time.

We have remarked above, that theſe experiments were made in a particular ſtate of the air; and the law of diſſipation aſcertained by them is of courſe adapted only to that given ſtate. In a different ſtate of the air, even if this ſhould be impregnated with the ſame proportion of moiſture, the law of diſſipation may be different. The inference which M. Coulomb expected to draw from his experiments was, that the ratio of diſſipation would prove to be leſs than the cube of the quantity of water held in ſolution, except when that quantity of water was what the air was capable of holding in ſolution at the given temperature.

This is agreeable to obſervation; for we know that air which is conſidered as dry, that is, when it is not nearly ſaturated with moiſture, is the moſt favourable to electrical phenomena.

Such is the general reſult of Coulomb's experiments on the diſſipation of electricity into the air.

The method in which M. Coulomb examined the diſſipation along imperfect conductors, by means of this inſtrument, was, by completely inſulating the ball *t*, and then, after obſerving the loſs ſuſtained by a body in contact with it from the air, ſliding a metallic rod down the inſulating ſtalk, till the diſſipation began to exceed what took place only by the air.

From his experiments reſpecting the diſſipation along imperfect conductors, he found that this took place in a different manner from that in which electricity eſcaped by communication with the contiguous air. The electricity ſeems to be diffuſed chiefly along the ſurface of the inſulator, and appears principally to be produced by the moiſture that is more or leſs attached to it. M. Coulomb illuſtrates this in the following manner.

Water is found to adhere to the ſurface of all bodies, from which it is prevented by adheſion from eſcaping when the bodies are electrified, and is thus rendered capable of receiving a greater degree of electric power. Let us ſuppoſe that the particles of moiſture are diſpoſed uniformly over the ſurface, with intervals between them; the electricity that is communicated to one particle, muſt acquire a certain degree of denſity, before it can fly from this particle to the next, acroſs the intervening inſulating ſpace. When an imperfect conductor of this kind is electrified at one extremity, the communicated electricity, in paſſing to the other extremity, muſt be weakened every ſtep in paſſing from particle to particle.

Suppoſe we have three adjacent particles, which we may call *a*, *b*, and *c*; we infer from N° 374 of the article ELECTRICITY, that the motion of *b* is ſenſibly effected, only by the difference of *a* and *c*; and therefore the paſſage of electric fluid from *b* to *c*, requires that this difference be ſuperior, or at leaſt equal to the force neceſſary for clearing this coercive interval. Let a particle paſs over. The denſity of fluid of the particle *b* is diminiſhed, while the denſity of the particle on the other ſide of *a* remains as before. Therefore ſome fluid will paſs from *a* to *b*, and from the particle preceding *a* to *a*; and ſo on, till we come to the electrified end of this inſulator. It is plain, from this conſideration, that we muſt at laſt arrive at a particle beyond *c*, where the whole repulſion of the preceding particle is juſt ſufficient to clear the coercive interval. Some fluid will come over; and the repulſion of this, acting now in the oppoſite direction, will prevent any fluid from coming to ſupply its place in the particle which it has juſt quitted; the transferrence of fluid will therefore ſtop here, and beyond this point the inſulation will be complete. Hence we perceive that there is a mathematical relation between the inſulating power, and the length of the canal; and this may be aſcertained by the theory which we adopted in the article ELECTRICITY. We ſhall here give an inſtance of this inveſtigation; and, for the ſake of ſimplicity, we ſhall take a very probable caſe, viz. where the inſulating interval, or, as we may more properly call it, the coercive interval, is equal in every part of the canal.

Let R repreſent the coercive power of the inſulator, or the degree of force required to clear the coercive interval between two particles. Suppoſe a ball C, fig. 16. ſuſpended by a ſilken thread AB; and let us denote the quantity of redundant fluid in the ball by C, and let the denſities at the different points of the canal be denoted by AD, P*d*, &c. ordinates to ſome curve D*d*B, cutting the axis in B, the point where the thread AB begins to inſulate completely. Let P*p* be an element of the axis; draw the ordinate *pf*, a tangent to the curve *df*F, the normal *d*E, and draw *fe* perpendicular to P*d*. Suppoſe AC=*r*, AP=*x*, and P*d*=*y*. Then we ſhall have P*p*=$\dot{x}$, and *de*=$-\dot{y}$. It was ſhewn in N° 374. of the article ELECTRICITY, that the only ſenſible action of the fluid on a particle at P is $-\frac{y\dot{y}}{x}$, when the action of the redundant fluid in the globe on the particle at P, having the denſity *y*, is denoted by $\frac{Cy}{(r+x)^2}$. Therefore $\frac{y\dot{y}}{x}$ is =R, the coercive power of the thread, which is ſuppoſed to be conſtant, $\frac{Pd \times de}{Pp}$ is therefore equal to ſome conſtant line R. But P*p* (or *fe*) : *de* = P*d* : PE. The ſubnormal PE, is therefore a conſtant line. But as this is the property of a parabola, the curve of denſity D*d*B muſt be a parabola, of which 2PE = 2R, is the parameter.

COR. 1.—The denſities at different points of an imperfect inſulator are in the ſubduplicate ratio of their diſtances from the point of complete inſulation: for Pd^2 : AD^2 = BP : BA.

COR. 2.—The lengths of canal requiſite for inſulating different denſities of the electric fluid are in the duplicate ratio of their denſities; for AB = $\frac{AD^2}{2PE}$, and PE is a conſtant quantity.

COR. 3.—The length of canal requiſite for inſulation is inverſely as its coercive power, and may be repreſented by $\frac{D^2}{R}$. For AB = $\frac{DA^2}{2PE} = \frac{D^2}{2R}$.

If we reflect on this theory, we ſhall perceive, that our formulæ determine the diſtribution of fluid along the ſurface of an imperfect conductor, only in a certain manner, ſuppoſing that the ball C has received a certain determinate portion of fluid, for this portion diffuſing itſelf, particle by particle, through the conducting matter, will extend to *b* in ſuch a manner, as that

Electrometer. the repulsion shall be everywhere in equilibrio with the coercive power of the insulating interval, taken at a *maximum*. We must here remark that this resistance is not *active*, but only coercive, and may be compared to the resistance afforded by viscidity or friction. Any repulsion of electric fluid, which falls short of this, will not disturb the stability of the fluid that is spread along the canal, according to any law whatever. So that if AD represent the electric density of the globe, and remain constant, any curve of density will answer, provided that $\frac{d\dot{d}}{\dot{x}}$ be everywhere less than R. It is therefore an indeterminate problem, to assign in general the disposition of fluid in the canal. The density is as the ordinates of a parabola on this supposition only that the maximum of R is everywhere the same. And, in this case, the distance AB is a minimum: for, in other cases of density we must have $\frac{d\dot{d}}{\dot{x}}$ less than R. If, therefore, we vary a single element of the curve D*d* B, in order that the stability of the fluid may not be disturbed, having *d* constant, we must necessarily have x larger, that $\frac{d\dot{d}}{\dot{x}}$ may still be less than R; that is, we must lengthen the axis.

The reasonings which have thus been deduced from theory, were confirmed by M. Coulomb in a numerous set of experiments. These are chiefly valuable for having stated the relation that subsists between the electric density, and the length of support necessary for complete insulation. But as M. Coulomb has not given us the scale of his electrometer, according to which the absolute measures of the densities were determined, the experiments can be of but little use till this be known.

We hinted, at the end of the theoretical part of ELECTRICITY, that the theory of Volta's *condenser* might be more satisfactorily explained after we had considered the above experiments of Coulomb. The account which we gave of the condenser in Chap. xiii. of that article, (chiefly from Cavallo), was the only one we could properly give in that early part of our view of the science. We are now prepared for a more scientific account of the effects of that instrument. The following is nearly the manner in which Dr Robison considered the subject.

Let the cover of an electrophorus be furnished with a graduated electrometer, such as may indicate the proportional *degrees of electricity*; electrify it positively to any degree, we shall suppose six, while it is held in the hand, at a little distance, directly over a metallic plate lying on a wine glass, or such like insulating stand, but made to communicate with the ground by a wire. Now bring it gradually down towards the plate. Theory teaches, and we see it confirmed by experiment, that the electrometer will gradually subside, and will perhaps fall to 2°, before the electricity is communicated in a spark: but let us stop it before this happens; the attraction of the lying plate produces a compensation of four degrees of the mutual repulsion of the parts of the cover, by condensing the fluid on its inferior surface, and forming a deficient stratum above. This needs no farther explanation, after what we said under ELECTRICITY, on the charging of coated glass plates. Now we may suppose that the escape of the fluid from this body into the air, begins as soon as it is electrified to 6°, and that it will fly to the insulated plate with the degree 2, if it be brought nearer. But if we can prevent this communication to the insulated plate, by interposing an electric, we may electrify the cover again, while so near the metallic plate, to 6°, before it will pass off into the air. If now it be removed from the lying plate, the fluid would cause the electrometer to rise to 10°, if it did not immediately pass off; and an electric excitement of any kind which could raise this body only to 6° by its intensity, will, by means of this apparatus, raise it to the degree 10, if it be sufficiently copious in extent. If we do the same thing when the wire which connects the lying plate with the ground is taken away, we know that the same diminution of the electricity of the other plate cannot be produced by bringing it down near the lying insulated plate. Electrometer.

The theory of Volta's *condenser* now becomes very simple. M. Volta seems to have obscured his conceptions of it, by being intent on the electrophorus which he had lately invented, and was thus led into fruitless attempts to explain the advantages of the imperfect conductor above the perfect insulator. But the condensing apparatus is wholly different from an electrophorus; its operations are more analogous to those of a coated plate not charged, and insulated only on one side; and such a coated plate lying on a table will be a complete condenser, if the upper coating be of the same dimensions as the plate of the condenser. All the directions given by M. Volta for preparing the the imperfect conductors prove, that the effect produced is to make them as perfect conductors as possible for any degree of electricity that exceeds a certain small intensity, but such as shall not suffer this very weak electricity to clear the first step of the conducting space. The marble must be thoroughly dried, and even heated in an oven, and either used in this warm state, or must be varnished, so as to prevent the reabsorption of moisture. We know that marble of slender dimensions, so as to be completely dried throughout, will not conduct electricity till it has again become moist. A thick piece of marble is rendered dry only superficially, and still conducts internally. It is then in the best possible state for a condenser. The same is the case with dry unbaked wood. Varnishing the upper surface of a piece of marble or wood is equivalent to covering it with a thin glass plate. Now by this method of covering the top of the marble, a book, or even the table, with a piece of clean dry silk, they all become most perfect condensators. This view of the matter has great advantages. We learn from it how to form a condensing apparatus much more simple and at the same time much more efficacious. We require only the simple moveable plate, which must be covered on the under side with a very thin coating of the finest coachpainters varnish. By connecting this, by a wire, with the substance whose weak electricity is to be examined, this electricity will be raised in the proportion of the thickness of the varnish to the fourth of the plate's diameter. This condensation will be produced by detaching the wire from the insulating handle of the condensing plate, and then lifting this from the table on which it was lying. It will then afford sparks, though the original electricity

Fig. 1.

Fig. 2.

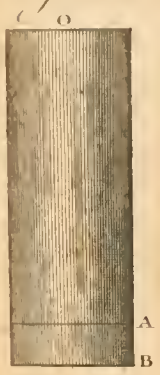

Fig. 3.

Fig. 4.

Fig. 5.

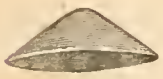

Fig. 6.

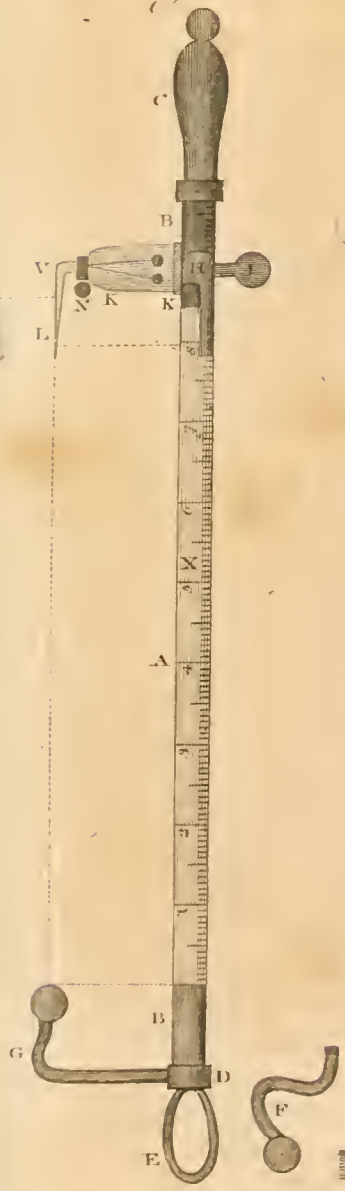

Fig. 7.

Fig. 8.

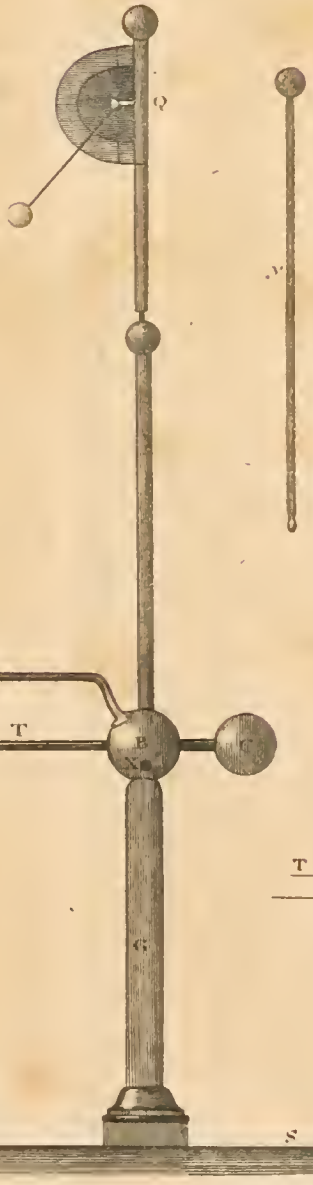

Fig. 9.

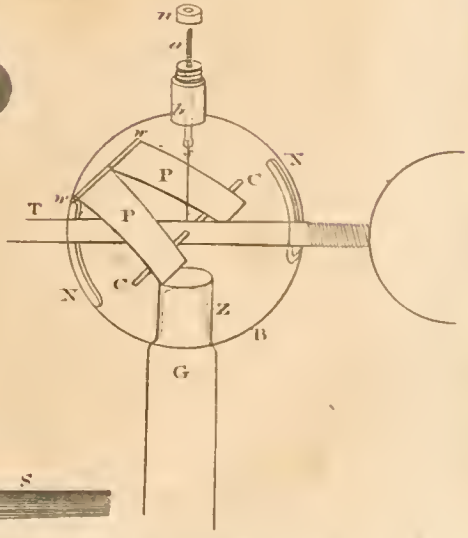

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Fig. 10.

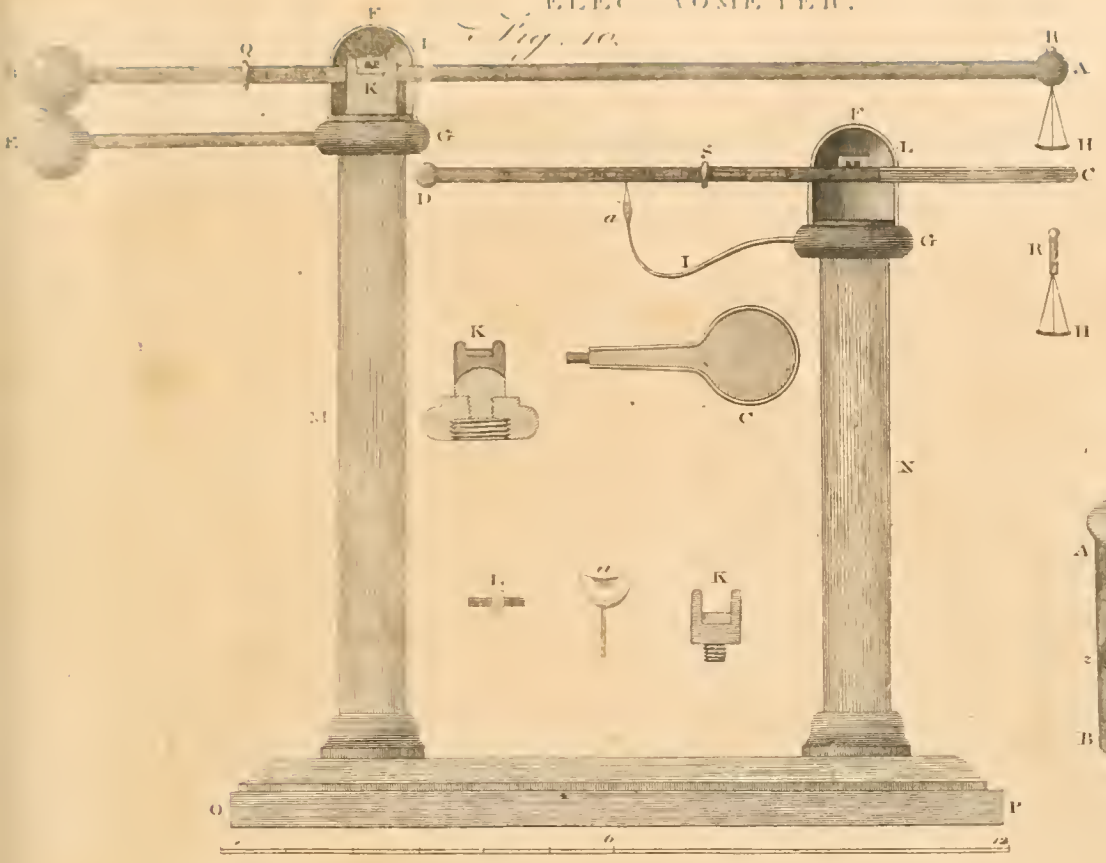


Fig. 11.

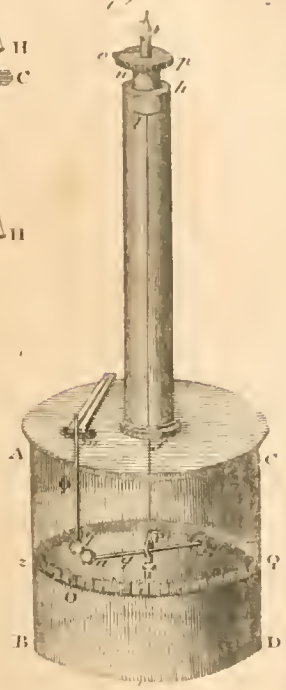


Fig. 12.

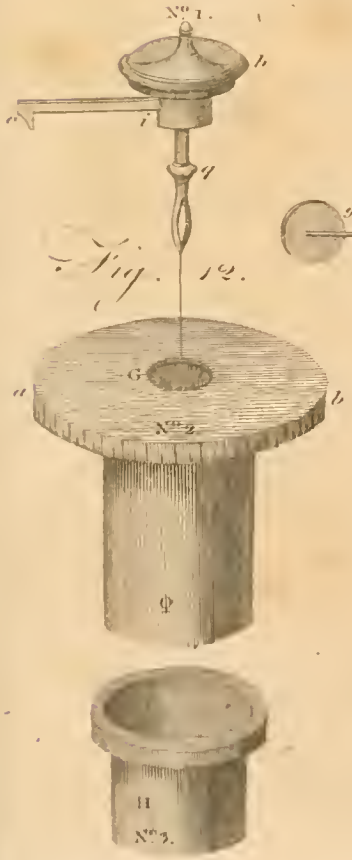


Fig. 13.

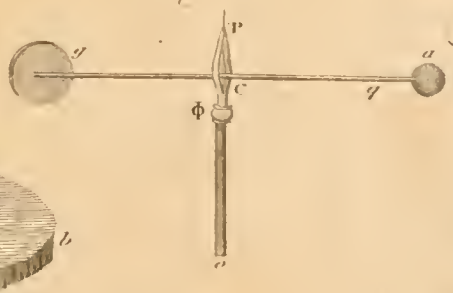


Fig. 14.

Fig. 15.

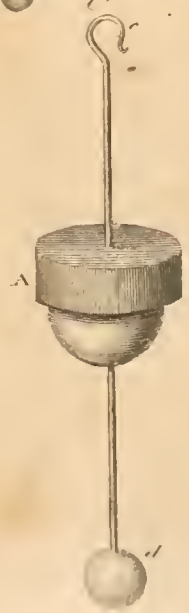
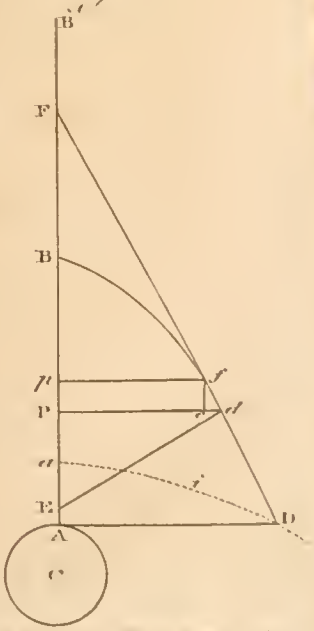


Fig. 16.



Allen & Wain, Mad.t Sculpsit, Lond.

Electrophorus || Elements.

electricity was not ſtrong enough to affect the moſt delicate electrometer.

ELECTROPHORUS. See ELECTRICITY *Index*.

ELECTRUM, in *Natural Hiſtory*. See AMBER.

ELECTUARY, in *Pharmacy*, a form of medicine compoſed of powders and other ingredients, incorporated with ſome conſerve, honey, or ſyrup; to be divided into doſes, like boluſes, when taken.

Voſſius obſerves, that all the remedies preſcribed for the ſick, as well as the confections taken by way of regale, were called by the Greeks εκλειγματα, and εκλεικτα, of the verb λειχω, "I like;" whence, ſays he, was formed the Latin *electarium*, and afterwards *electuarium*. This conjecture he ſupports from the laws of Sicily, where it is ordained, that *electuaries*, ſyrups, and other remedies, be prepared after the legal manner. The Bollandiſts, who relate this etymology, ſeem to confirm it. For the compoſition and different ſorts of electuaries. See PHARMACY.

ELEEMOSYNA *Carucarum*, or *pro Aratris*, or *Aratri*, in our ancient cuſtoms, a penny which King Ethelred ordered to be paid for every plough in England towards the ſupport of the poor. Sometimes it is alſo called *eleemoſyna regis*, becauſe firſt appointed by the king.

ELEEMOSYNARIUS, in our old writers, is uſed for the almoner or peculiar officer who received the eleemoſynary rents and gifts, and diſtributed them to pious and charitable uſes. There was ſuch an officer in all religious houſes. The biſhops alſo uſed to have their almoners, as now the king has.

ELEGANCE, (from *eligo* "I chooſe,") denotes a manner of doing or ſaying things politely, agreeably, and with choice. With choice, ſo as to riſe above the common manners; politely, ſo as to ſtrike people of delicate taſte; and agreeably, ſo as to diffuſe a reliſh which gratifies every body.

ELEGANCE, in oratory and compoſition, an ornament of politeneſs and agreeableneſs ſhown in any diſcourſe, with ſuch a choice of rich and happy expreſſions, as to riſe politely above the common manners, ſo as to ſtrike people of a delicate taſte.

It is obſerved, that elegance, though irregular, is preferable to regularity without elegance: that is, by being ſo ſcrupulous of grammatical conſtruction, we loſe certain licences wherein the elegance of language conſiſts.

ELEGIAC, in ancient poetry, any thing belonging to elegy. See ELEGY.

ELEGIT, in *Law*, a writ of execution, which lies for a perſon who has recovered debt or damages; or upon a recognizance in any court, againſt a defendant that is not able to ſatisfy the ſame in his goods.

ELEGY, a mournful and plaintive kind of poem. See the article POETRY.

ELEMENTS, in *Phyſics*, the firſt principles of which all bodies in the ſyſtem of nature are compoſed.

Theſe are ſuppoſed to be few in number, unchangeable, and by their combinations to produce that extenſive variety of objects to be met with in the works of nature.

That there is in reality ſome foundation for this doctrine of elementary bodies is plain; for there are ſome principles evidently exempted from every change or decay, and which can be mixed or changed into different forms of matter. A perſon who ſurveys the works of nature in an inattentive manner, may perhaps form a contrary opinion, when he conſiders the numerous tribes of foſſils, plants, and animals, with the wonderful variety that appears among them in almoſt every inſtance. He may from thence be induced to conclude, that nature employs a vaſt variety of materials in producing ſuch prodigious diverſity. But let him inquire into the origin of this apparent diverſity, and he will find that theſe bodies which ſeem the moſt different from each other are compoſed nearly of the ſame elements. Thus the blood, chyle, milk, urine, &c. as well as the various ſolid parts of animals, are all compoſed of one particular ſubſtance; graſs, for inſtance, by the aſſiſtance of air and water, and even ſometimes of very inſipid kinds of graſs. The ſame ſimplicity preſents itſelf in the original compoſition of the nouriſhment of vegetables, notwithſtanding the variety among them with reſpect to hardneſs, ſoftneſs, elaſticity, taſte, odour, and medical qualities. They chiefly depend, for theſe, upon water and the light of the ſun; and the ſame ſimplicity muſt take place in animals that are fed on vegetables. The analyſis of animal ſubſtances confirms this hypotheſis; for they can all be reduced into a few principles, which are the ſame in all, and only differ with regard to the proportions in which they are combined. With regard to animals, the caſe appears to be the ſame: and the more we are acquainted with them, the more reaſon we have to believe that the variety in their origin is very ſmall. Elements.

Notwithſtanding the infinite variety of natural productions, therefore, it appears, that the materials employed in their formation are but few; that theſe are uniformly and certainly the ſame, totally exempted from any change or decay; and that the conſtant and gradual change of one body into another is produced by the various ſeparations and combinations of the original and elementary parts, which is plain from the regularity and uniformity of nature at all times. There is a change of forms and combinations through which it paſſes, and this has been the caſe from the earlieſt accounts of time; the productions of nature have always been of the ſame kind, and ſucceeded one another in the ſame order. If we examine an oak, for inſtance, we find it compoſed of the ſame matter with that of any other that has exiſted from the earlieſt ages. This regularity and uniformity in the courſe of nature ſhows that the elementary parts of bodies are permanent and unchangeable; for if theſe elementary particles which conſtituted an oak ſome thouſand years ago, had been undergoing any gradual decay, the oaks of the preſent times would have been found conſiderably different from thoſe that exiſted long ago; but as no difference has been obſerved, it would ſeem that the ultimate elements of bodies have always continued the ſame.

Reflections of this kind have ſuggeſted an idea of ſeveral principal elements of which all other bodies are compoſed, which by their various combinations furniſhed all the variety of natural bodies. Democritus, and other great philoſophers of antiquity, fixed the number to four, which have retained the name of elements ever ſince. Theſe are, fire, air, earth, and water; each of which they imagined was naturally

Elements. diſpoſed to hold its own place in the univerſe. Thus, the earth, as heavieſt, naturally tended towards the centre, and occupied the lower parts; the water, as approaching next to it in gravity, was ſpread chiefly on the outſide of the earth; the air, being more ſubtile and rare, occupied the middle place; while the fire, being ſtill more ſubtile and active, receded to the greateſt diſtance of all, and was ſuppoſed to compoſe the planets and ſtars. This ſyſtem was extended to all the productions of nature. Meteors were produced from a combination of fire and air; animals were conſidered as compoſed of earth and water; and thoſe that were warm had likewiſe a proportion of the element of fire. Thus they went on, explaining ſome of the moſt ſtriking qualities of the ſeveral productions of nature from the different proportions of the four elements they contained.

But though this ſyſtem appears not at all deſtitute of beauty and propriety, and on this account has been long received, we know from modern diſcoveries that theſe four ſubſtances are not really elementary bodies; nor do they anſwer our purpoſe in forming a ſyſtem, as we know too little of the intimate ſtructure and texture of them to enable us to explain other bodies by them.

Any other attempts that have been made to aſſign the number of elementary bodies have been much leſs fortunate. The older chemiſts, with Paracelſus at their head, pretend to ſpeak of four elementary bodies, ſalt, ſulphur, earth, and mercury: but when we attempt to form an idea of what they mean, we find it very perplexed; and that the expreſſions concerning them are enveloped in ſo much obſcurity, that they cannot be comprehended; and the theory is built entirely upon experiments made on metallic ſubſtances.

Attempts have been made by ſome to ſhow that the elements, whatever they are, muſt neceſſarily be inviſible or imperceptible by any of our ſenſes. An inquiry into their number or properties therefore muſt be attended with very little ſucceſs; and all the knowledge we can have upon the ſubject muſt be drawn from a view of their combinations, and reaſoning analogically from the tranſmutations we obſerve to take place in nature. The modern diſcoveries in aerology have enabled us to proceed farther in this way than what it was poſſible for the ancient philoſophers to do. We now find that all the different kinds of air are compoſed of that inviſible and ſubtile fluid named *heat*, united in a certain way with ſome other ſubſtance: by which union the compound acquires the properties of gravitation, expanſion, rarefaction, &c. for pure heat, unleſs when united with ſome terreſtrial ſubſtance, neither gravitates nor expands. This is evident from the phenomena of the burning glaſs, where the light concentrated in the focus will neither heat the air nor water, unleſs it meets with ſomething with which it can form a permanent union. Heat therefore is juſtly to be conſidered as one of the original elements; being always capable of uniting with bodies, and of being extricated from them unchanged; while the ſame bodies are by their union with it changed into various forms; water, for inſtance, into ice or vapour, both of which return into their original ſtate by the abſtraction or addition of heat in a certain degree. Hence it becomes almoſt natural to conclude, that there are only two elements in the univerſe: and this opinion we find adopted by ſeveral philoſophers, particularly the count de Treſſan in Elements. his Eſſay on the Electric Fluid. According to this doctrine, two primitive material ſubſtances ſeem to exiſt in nature; one that inceſſantly acts, and to which it is eſſential to be in motion; the other abſolutely paſſive, and whoſe nature it is to be inert, and move entirely as directed by the former. Should this doctrine be adopted, little difficulty would occur in determining the active matter to be that univerſal fluid which in its various modifications of light, heat, and electricity, has ſuch a ſhare in the operations of nature. But in fixing on the paſſive element we are greatly embarraſſed; nor are the diſcoveries in aerology or any other ſcience as yet able to remove the difficulty entirely. According to the doctrines which long prevailed among chemical philoſophers, there are three things that ſeem to be unchangeable, viz. earth; phlogiſton; and that inviſible, though terreſtrial and gravitating principle, called by the antiphlogiſtians the *oxygenous* or acidifying principle, and by the phlogiſtians the baſis of dephlogiſticated air. In our experiments, ſay they, on the firſt, we find that earth, though vitrified by the moſt intenſe fire, may be recovered in its proper form: and ſome very pure earths, particularly magneſia alba, cannot be changed even in the focus of the moſt powerful mirror. In like manner we may diſſipate charcoal *in vacuo* by the ſolar rays, and the compound is inflammable air: we may decompoſe this compound by a metallic calx, and we have our charcoal again unchanged, for all metals contain charcoal in ſubſtance. Let us try to deſtroy it by common fire, and we have it then in the fixed air produced, from which it may be recovered unchanged by means of the electric ſpark. With the baſis of dephlogiſticated air the caſe is ſtill more difficult; for we cannot by any means procure a ſight of it by itſelf. We may combine it with heat, and we have dephlogiſticated air; to the compound we may add charcoal, and we have fixed air: by decompoſing the former by burning iron in it, we have the metal greatly increaſed in weight by ſome unknown ſubſtance: and if we attempt to ſeparate the latter, we have water, or ſome kind of vapour which ſtill conceals it from our view.

In ſome experiments which were made by the ingenious Mr Watt, it was found that nitrous acid might be phlogiſticated by the pureſt earth or metallic calx; whence, according to this doctrine, it is not unreaſonable to ſuppoſe that phlogiſton may be only a certain modification of earth, and not an element diſtinct from it: but with regard to the baſis of dephlogiſticated air, no experiment has ever ſhown that it can either be procured by itſelf, or changed into any other ſubſtance; ſo that it appears to have the nature of an element as much as light or heat. Though we ſhould therefore be inclined to divide the whole matter of the univerſe into two claſſes, the one active and the other acted upon, we muſt allow that the paſſive matter even on this earth is not preciſely of the ſame kind: much leſs are we to extend our ſpeculations in this reſpect to the celeſtial regions; for who can determine whether the ſubſtance of the moon is the ſame with that of our earth, or that the elements of Jupiter are the ſame with thoſe of Saturn? There is even a difficulty with regard to the diviſion which ſeems ſo well eſtabliſhed, viz. of matter in general into active

Element || Elephanta.

active and passive; for no person can prove, that the matter which is active in one case may not be passive in another, and occasionally resume its activity. Something like this certainly happens in the case of the electric fluid, which is modified into heat or light, according to different circumstances; and we cannot know but it is the very same substance that constitutes the most solid bodies. This opinion at least did not seem absurd to Sir Isaac Newton, who proposed it as a query, Whether gross bodies and light were not convertible into one another? The end of our inquiries on this subject therefore must be, That the universe may be composed of many elements, or of one element; and of the nature of these elements, or of the single one, we know nothing.

ELEMENT, in a figurative sense, is used for the principles and foundations of any art or science; as Euclid's Elements, &c.

ELEMENTS, in *Astronomy*, are those principles deduced from astronomical observations and calculations, and those fundamental numbers which are employed in the construction of tables of the planetary motions. Thus, the elements of the theory of the sun, or rather of the earth, are his mean motion and eccentricity, and the motion of the aphelia. The elements of the theory of the moon are its mean motion; that of its node and apogee, its eccentricity, the inclination of its orbit to the plane of the ecliptic, &c.

ELEMI, or ELEMY, in the *Materia Medica*. See AMYRIS.

ELENCHUS, in antiquity, a kind of ear-rings set with large pearls.

ELENCHUS, in *Logic*, by the Latins called *argumentum* and *inquisitio*, is a vicious or fallacious argument, which deceives under the appearance of a truth; the same with what is otherwise called *sophism*.

ELEPHANT. See ELEPHAS, MAMMALIA *Index*.

American ELEPHANT: An animal only known in a fossil state, and that but partially, from the teeth, some of the jaw-bones, the thigh-bones, and vertebræ, found with many others five or six feet beneath the surface on the banks of the Ohio. But these bones differ in several respects from those of the elephant; for which, see *Fossil Bones*. As yet the living animal has evaded our search. Mr Pennant thinks it "more than probable, that it still exists in some of those remote parts of the vast new continent unpenetrated yet by Europeans. Providence maintains and continues every created species; and we have as much assurance that no race of animals will any more cease while the earth remains, than *seed-time and harvest, cold and heat, summer and winter, day or night.*" See MAMMUTH.

Elephant Beetle. See SCARABÆUS.

Knights of the ELEPHANT, an order of knighthood in Denmark, conferred upon none but persons of the first quality and merit. It is also called the *order of St Mary*. Its institution is said to have been owing to a gentleman among the Danish croises having killed an elephant, in an expedition against the Saracens, in 1184; in memory of which, King Canutus instituted this order, the badge of which is a towered elephant, with an image of the holy virgin encircled with rays, and hung on a watered sky-coloured ribbon, like the George in England.

ELEPHANTA, a small, but very remarkable island, about five miles from the castle of Bombay in the East Indies. Of this we have the following description in Mr Grose's Voyage to the East Indies. "It can at most be but about three miles in compass, and consists of almost all hill: at the foot of which, as you land, you see, just above the shore, on your right, an elephant, coarsely cut out in stone, of the natural bigness, and at some little distance not impossible to be taken for a real elephant, from the stone being naturally of the colour of that beast. It stands on a platform of stones of the same colour. On the back of this elephant was placed, standing, another young one, appearing to have been all of the same stone, but has been long broken down. Of the meaning, or history, of this image, there is no tradition old enough to give any account. Returning then to the foot of the hill, you ascend an easy slant, which about half way up the hill brings you to the opening or portal of a large cavern hewn out of a solid rock into a magnificent temple: for such surely it may be termed, considering the immense workmanship of such an excavation; and seems to me a far more bold attempt than that of the pyramids of Egypt. There is a fair entrance into this subterraneous temple, which is an oblong square, in length about 80 or 90 feet, by 40 broad. The roof is nothing but the rock cut flat at top, and in which I could not discern any thing that did not show it to be all of one piece. It is about 10 feet high, and supported towards the middle, at equidistance from the sides and from one another, with two regular rows of pillars of a singular order. They are very massive, short in proportion to their thickness, and their capital bears some resemblance to a round cushion pressed by the superincumbent mountain, with which they are also of one piece. At the further end of this temple are three gigantic figures; the face of one of them is at least five feet in length, and of a proportionable breadth. But these representations have no reference or connection either to any known history or the mythology of the Gentoos. They had continued in a tolerable state of preservation and wholeness, considering the remoteness of their antiquity, until the arrival of the Portuguese, who made themselves masters of the place; and in the blind fury of their bigotry, not suffering any idols but their own, they must have even been at some pains to maim and deface them, as they now remain, considering the hardness of the stone. It is said they even brought field-pieces to the demolition of images, which so greatly deserved to be spared for the unequalled curiosity of them. Of this Queen Catherine of Portugal was, it seems, so sensible, that she could not conceive that any traveller would return from that side of India without visiting the wonders of this cavern; of which too the sight appeared to me to exceed all the descriptions I had heard of them. About two-thirds of the way up this temple, on each side, and fronting each other, are two doors or outlets into smaller grots or excavations, and freely open to the air. Near and about the door-way, on the right hand, are several mutilated images, single and in groups. In one of the last, I remarked a kind of resemblance to the story of Solomon dividing the child, there standing a figure with a drawn sword, holding in one hand an infant with the head downwards, which it appears in act to cleave through the middle. The

Elephanta.

outlet

Elephantiasis || Eleave.

outlet of the other on the left hand is into an area of about 20 feet in length and 12 in breadth; at the upper end of which, as you turn to the right, preſents itſelf a colonnade covered at top, of 10 or 12 feet deep, and in length anſwering to the breadth of the area: this joins to an apartment of the moſt regular architecture, an oblong ſquare, with a door in perfect ſymmetry; and the whole executed in quite a contrary taſte and manner from any of the oldeſt or beſt Gentoo buildings anywhere extant. I took particular notice of ſome paintings round the cornices, not for any thing curious in the deſign, but for the beauty and freſhneſs of the colouring, which muſt have laſted ſome thouſands of years, on ſuppoſing it, as there is all reaſon to ſuppoſe it, cotemporary with the building itſelf. The floor of the apartment is generally full of water, its pavement or ground-work not permitting it to be drawn off or to be ſoaked up. For it is to be obſerved, that even the cavern itſelf is not viſitable after the rains until the ground of it has had time to dry into a competent hardneſs."

ELEPHANTIASIS, called alſo the *lepra of the Arabians*, in *Medicine*, a chronical diſeaſe, one of the two ſpecies of leproſy which affects the whole body, where even the bones as well as the ſkin are covered with ſpots and tumours, which being red at laſt turn black. See MEDICINE *Index*.

ELEPHANTINE, or ELEPHANTIS, in *Ancient Geography*, an iſland in the Nile to the ſouth of Syene; with a cognominal town, where the navigation on the Nile ends, becauſe juſt below the leſs cataract. And here to the weſt of the Nile ſtood the laſt Roman garriſon (Notitia Imperii).

ELEPHANTINE, in Roman antiquity, an appellation given to the books wherein were regiſtered the tranſactions of the ſenate and magiſtrates of Rome, of the emperors or generals of armies, and even of the provincial magiſtrates; the births and claſſes of the people and other things relating to the cenſus.

They are ſuppoſed to have been ſo called, as being made of leaves of ivory or elephants tuſks.

ELEPHANTOMACHI. See ETHIOPIA.

ELEPHANTOPUS, a genus of plants belonging to the ſyngeneſia claſs, and in the natural method ranking under the 49th order, *Compoſitæ*. See BOTANY *Index*.

ELEPHAS, the ELEPHANT, a genus of quadrupeds belonging to the order of bruta. See MAMMALIA *Index*.

ELEVATION, the ſame with ALTITUDE or height.

ELEVATION of the Hoſt, in the church of Rome, that part of the maſs where the prieſt raiſes the hoſt above his head for the people to adore.

ELEVATOR, in *Anatomy*, the name of ſeveral muſcles, ſo called from their ſerving to raiſe the parts of the body to which they belong.

ELEVATORY, in *Surgery*, an inſtrument for raiſing depreſſed on fractured parts of the ſkull, to be applied after the integuments and periosteum are removed. See SURGERY.

ELEVE, a term purely French, though of late uſed alſo in our language. Literally it ſignifies a diſciple or ſcholar bred up under any one, being formed from the Italian *allievo*, an "apprentice" or "novice."

It was firſt uſed by the French writers in ſpeaking of painters; ſuch a painter was an eleve of Da Vinci, of Raphael, &c. From painting it came to be applied to ſuch as ſtudied or learned any other art under a maſter. In the Royal Academy of Sciences, there were 20 eleves: and in that of inſcriptions, 10 eleves. The eleves are to act in concert with the penſionaries. See ACADEMY. Eleventh, Eleuſinia.

The denomination *eleve*, however, has been ſince ſuppreſſed, and that of *adjoint* ſubſtituted in its room; becauſe every body did not know the ſenſe affixed to it by the academy: and now the penſionary academiſts have not, as formerly, each of them an eleve; but the eleves are become adjoints, or aſſociates of the academy.

ELEVENTH, or chord of the eleventh. See INTERVAL.

ELEUSINIA, in Grecian antiquity, a feſtival kept in honour of Ceres, every fourth year by ſome ſtates, but by others every fifth. The Athenians celebrated it at Eleuſis, a town of Attica: whence the name.

Ceres, ſays an Athenian orator (Iſocrates), wandering in queſt of her daughter Proſerpine, came into Attica, where ſome good offices were done her, which it is unlawful for thoſe who are not initiated to hear. In return ſhe conferred two unparalleled benefits; to wit, the knowledge of agriculture, by which the human race is raiſed above the brute creation; and the myſteries, from which the partakers derive ſweeter hopes than other men enjoy, both as to the preſent life and to eternity. It was the popular opinion, that the Eleuſinian goddeſſes ſuggeſted prudent counſel to their votaries, and influenced their conduct; that theſe were reſpected in the infernal regions, and had precedence in the aſſemblies of the bleſſed; while the unhallowed were in utter darkneſs, wallowing in mire, or labouring to fill a leaky veſſel. The Athenians were ſolicitous to ſecure theſe advantages to their children, by having them initiated as ſoon as was allowed.

Ceres was ſuppoſed to be particularly partial to Eleuſis and its vicinity. *There* were the memorials of her preſence and of her bounty; the well named *Callichorus*, by which ſhe had reſted, in the reign of Erectheus; the ſtone on which ſhe ſat, named *the ſorrowful*; the Rharian plain, where barley was firſt ſown; and the threſhing-floor and altar of Triptolemus, a herdſman whom ſhe inſtructed in the culture of that grain, the uſe of which ſucceeded to acorns. Her myſteries continued to poſſeſs a pre-eminence in holineſs, and to be accounted as much ſuperior to all other religious feſtivals as the gods were to the heroes. Even the garments worn at the ſolemnity were ſuppoſed to partake of their efficacy, and to be endued with ſignal virtues. It was uſual to retain them until they were periſhing; and then to dedicate them in the temple, or to reſerve them for the purpoſe of enwrapping newborn children.

The myſtic temple, as it was called, provided by Pericles for the ſolemnity, created ſuch awe by its ſanctity as could be equalled only by the effect of its beauty and magnitude, which excited aſtoniſhment in every beholder. The profane or uninitiated were forbidden to enter it on any pretence. Two young Acarnanians happened inadvertently to mix with the crowd

Eleuſinia. crowd at the ſeaſon of the myſteries, and to go in; but the queſtion ſuggeſted by their ignorance preſently betrayed them, and their intruſion was puniſhed with death. The chief prieſt, hierophant, or myſtagogue, was taken from the Eumolpidæ, a holy family flouriſhing at Athens, and deſcended from Eumolpus, a ſhepherd and favourite of Ceres. He was enjoined celibacy, and wore a ſtole or long garment, his hair, and a wreath of myrtle. The grand requiſite, in his character were ſtrength and melody of voice, ſolemnity of deportment, magnificence, and great decorum. Under him, beſides many of inferior ſtation, was the daduchus or torch-bearer, who had likewiſe his hair, with a fillet; the prieſt, who officiated at the altar; and the hiero-ceryx or ſacred herald; all very important perſonages. The latter was of a family which claimed the god Mercury and Aglauros the daughter of Cecrops for its anceſtors.

The ſecrecy in which the myſteries were enveloped, ſerved to enhance the idea of their conſequence, and to increaſe the deſire of participation. It was ſo particular, that no perſon was allowed even to name the hierophant by whom he had been initiated. Public abhorrence and deteſtation awaited the babbler, and the law directed he ſhould die.

The Athenians ſuffered none to be initiated into theſe myſteries but ſuch as were members of their city. This regulation, which compelled Hercules, Caſtor, and Pollux, to become citizens of Athens, was ſtrictly obſerved in the firſt ages of the inſtitution, but afterwards all perſons, barbarians excepted, were freely initiated.

The feſtivals were divided into great and leſs myſteries. The leſs were inſtituted from the following circumſtance. Hercules paſſed near Eleuſis while the Athenians were celebrating the myſteries, and deſired to be initiated. As this could not be done, becauſe he was a ſtranger, and as Eumolpus was unwilling to diſpleaſe him on account of his great power, and the ſervices which he had done to the Athenians, another feſtival was inſtituted without violating the laws. It was called μικρα, and Hercules was ſolemnly admitted to the celebration and initiated. Theſe leſs myſteries were obſerved at Agræ near the Iliſſus. The greater were celebrated at Eleuſis, from which place Ceres has been called *Eleuſinia*. In later times the ſmaller feſtivals were preparatory to the greater, and no perſon could be initiated at Eleuſis without a previous purification at Agræ. This purification they performed by keeping themſelves pure, chaſte, and unpolluted, during nine days; after which they came and offered ſacrifices and prayers, wearing garlands of flowers, called ισμεγα or ιμηρα, and having under their feet Διος κωδιον, *Jupiter's ſkin*, which was the ſkin of a victim offered to that god. The perſon who aſſiſted was called υδραιος from υδωρ *water*, which was uſed at the purification, and they themſelves were called μυσται, *the initiated*.

A year after the initiation at the leſs myſteries they ſacrificed a ſow to Ceres, and were admitted in the greater, and the ſecrets of the feſtivals were ſolemnly revealed to them, from which they were called εποπται and εποπται, *inſpectators*.

This feſtival was obſerved in the month Boedromion or September, and continued nine days from the 15th till the 23d. During that time it was unlawful to arreſt any man, or preſent any petition, on pain of forfeiting a thouſand drachmas, or according to others on pain of death. It was alſo unlawful for thoſe who were initiated to ſit upon the cover of a well, to eat beans, mullets, or weazels. If any woman rode to Eleuſis in a chariot, ſhe was obliged by an edict of Lycurgus to pay 6000 drachmas. The deſign of this law was to deſtroy all diſtinction between the richer and poorer ſort of citizens. When the ſeaſon approached, the myſtæ or perſons who had been initiated only in the leſſer myſteries, repaired to Eleuſis to be inſtructed in the ceremonial. The ſervice for the opening of the temple, with morning ſacrifice, was performed. The ritual was then produced from the ſanctuary. It was enveloped in ſymbolical figures of animals, which ſuggeſted words compendiouſly, in letters with ligatures, implicated, the tops huddled together, or diſpoſed circularly like a wheel; the whole utterly inexplicable to the profane. The caſe, which was called *petroma*, conſiſted of two ſtones exactly fitted. The myſterious record was replaced after the reading, and cloſed up until a future feſtival. The principal rite was nocturnal, and confined to the temple and its environs. The myſtæ waited without, with impatience and apprehenſion. Lamentations and ſtrange noiſes were heard. It thundered. Flaſhes of light and of fire rendered the deep ſucceeding darkneſs more terrible. They were beaten, and perceived not the hand. They beheld frightful apparitions, monſters, and phantoms of a canine form. They were filled with terror, became perplexed and unable to ſtir. The ſcene then ſuddenly changed to brilliant and agreeable. The propylæa or veſtibules of the temple were opened, the curtains withdrawn, the hidden things diſplayed. They were introduced by the hierophant and daduchus, and the former ſhowed them the myſteries. The ſplendor of illumination, the glory of the temple and of the images, the ſinging and dancing which accompanied the exhibition, all contributed to ſoothe the mind after its late agitation, and to render the wondering devotee tranquil and ſelf-ſatisfied. After this inſpection, or, as it was called, the *autopſia*, they retired, and others advanced. The ſucceeding days were employed in purification, in ſacrifice, in pompous proceſſions, and ſpectacles, at which they aſſiſted, wearing myrtle crowns. The ſecond day was called αλαδε μυσται, *to the ſea, you that are initiated;* becauſe they were commanded to purify themſelves by bathing in the ſea. On the third day ſacrifices, and chiefly a mullet, were offered; as alſo barley from a field of Eleuſis. Theſe oblations were called Θυα, and held ſo ſacred that the prieſts themſelves were not, as in other ſacrifices, permitted to partake of them. On the fourth day they made a ſolemn proceſſion, in which the καλαθιον, *holy baſket of Ceres*, was carried about in a conſecrated cart, while on every ſide the people ſhouted χαιρε Δημητερ, *Hail, Ceres!* After theſe followed women, called κιστοφοροι, who *carried baſkets*, in which was ſeſamin, carded wool, grains of ſalt, a ſerpent, pomegranates, reeds, ivy boughs, certain cakes, &c. The fifth was called Η των λαμπαδων ημερα, *the torch day;* becauſe on the following night the people ran about with torches in their hands. It was uſual to dedicate torches to Ceres, and contend which ſhould offer the biggeſt.

Eleuſinia.

Eleuſinia. biggeſt, in commemoration of the travels of the goddeſs, and of her lighting a torch in the flames of Mount Ætna. The ſixth day was called Ιακχος, from Iacchus, the ſon of Jupiter and Ceres, who accompanied his mother in her ſearch after Proſerpine with a torch in his hand. From that circumſtance his ſtatue had a torch in his hand, and was carried in ſolemn proceſſion from the Ceramicus to Eleuſis. The ſtatue with thoſe that accompanied it, called Ιακχαγωγος, was crowned with myrtle. In the way nothing was heard but ſinging and the noiſe of brazen kettles as the votaries danced along. The way through which they iſſued from the city was called Ἱερα οδος, *the ſacred way*, the reſting place Ἱερα συκη, from a *fig-tree* which grew in the neighbourhood. They alſo ſtopped on a bridge over the Cephiſus, where they derided thoſe that paſſed by. After they had paſſed this bridge, they entered Eleuſis by a place called μυστικη εισοδος, *the myſtical entrance*. On the ſeventh day were ſports, in which the victors were rewarded with a meaſure of barley, as that grain had been firſt ſown in Eleuſis. The eighth day was called Επιδαυριων ἡμερα, becauſe once Æſculapius at his return from Epidaurus to Athens was initiated by the repetition of the leſs myſteries. It became cuſtomary therefore to celebrate them a ſecond time upon this, that ſuch as had not hitherto been initiated might be lawfully admitted. The ninth and laſt day of the feſtival was called Πλημοχοαι, *earthen veſſels*, becauſe it was uſual to fill two ſuch veſſels with wine; one of them being placed towards the eaſt, and the other towards the weſt; which, after the repetition of ſome myſtical words, were both thrown down, and the wine being ſpilt on the ground, was offered as a libation.

The ſtory of Ceres and Proſerpine, the foundation of the Eleuſinian myſteries, was partly local. It was both verbally delivered, and repreſented in allegorical ſhow. Proſerpine was gathering flowers when ſhe was ſtolen by Pluto. Hence the proceſſion of the holy baſket, which was placed on a car dragged along by oxen, and followed by a train of females, ſome carrying the myſtic cheſts, ſhouting, *Hail, Ceres!* At night a proceſſion was made with lighted torches, to commemorate the goddeſs ſearching for her daughter. A meaſure of barley, the grain which, it was believed, ſhe had given, was the reward of the victors in the gymnic exerciſes; and the tranſaction at the temple had a reference to the legend. A knowledge of theſe things and places, from which the profane were excluded, was the amount of initiation; and the mode of it, which had been deviſed by craft, was ſkilfully adapted to the reigning ſuperſtitions. The operation was forcible, and the effect in proportion. The prieſthood flouriſhed as piety increaſed. The diſpenſation was corrupt, but its tendency not malignant. It produced ſanctity of manners and an attention to the ſocial duties; deſire to be as diſtinguiſhed by what was deemed virtue as by ſilence.

Some have ſuppoſed the principal rites at this feſtival to have been obſcene and abominable, and that from thence proceeded all the myſterious ſecrecy. They were carried from Eleuſis to Rome in the reign of Adrian, where they were obſerved with the ſame ceremonies as before, though perhaps with more freedom and licentiouſneſs. They laſted about 1800 years, and were at laſt aboliſhed by Theodoſius the Great. Eleuſinia.

ELEUSIS, in *Ancient Geography*, a town in Attica, between Megara and the Piræus, celebrated for the feſtivals of Ceres. See the preceding article.—Thoſe rites were finally extinguiſhed in Greece upon the invaſion of Alaric the Goth. Eleuſis, on the overthrow of its goddeſs and the ceſſation of its gainful traffic, probably became ſoon an obſcure place, without character or riches. For ſome ages, however, it was not entirely forſaken, as is evident from the vaſt conſumption of the ancient materials, and from the preſent remains, of which the following account is given by Dr Chandler*. "The port was ſmall and of a circular form. The ſtones of one pier are ſeen above water, and the correſponding ſide may be traced. About half a mile from the ſhore is a long hill, which divides the plain. In the ſide next the ſea are traces of a theatre, and on the top are ciſterns cut in the rock. In the way to it, ſome maſſes of wall and rubbiſh, partly ancient, are ſtanding; with ruined churches; and beyond, a long broken aqueduct croſſes to the mountains. The Chriſtian pirates had infeſted the place ſo much, that in 1676 it was abandoned. It is now a ſmall village at the eaſtern extremity of the rocky brow, on which was once a caſtle; and is inhabited by a few Albanian families, employed in the culture of the plain, and ſuperintended by a Turk, who reſides in an old ſquare tower. The proprietor was Achmet Aga, the primate or principal perſon of Athens.

* *Travels into Greece*, p. 189.

"The myſtic temple at Eleuſis was planned by Ictinus, the architect of the Parthenon. Pericles was overſeer of the building. It was of the Doric order; the cell ſo large as to admit the company of a theatre. The columns on the pavement within, and their capitals, were raiſed by Coræbus. Mentagenes of Xypete added the architraves and the pillars above them, which ſuſtained the roof. Another completed the edifice. This was a temple *in antis*, or without exterior columns, which would have occupied the room required for the victims. The aſpect was changed to *Proſtylos* under Demetrius the Phalerean; Philo, a famous architect, erecting a portico, which gave dignity to the fabric, and rendered the entrance more commodious. The ſite was beneath the brow, at the eaſt end, and encompaſſed by the fortreſs. Some marbles, which are uncommonly maſſive, and ſome pieces of the columns, remain on the ſpot. The breadth of the cell is about 150 feet; the length, including the pronaos and portico, is 216 feet; the diameter of the columns, which are fluted, 6 inches from the bottom of the ſhafts, is 6 feet and more than 6 inches. The temple was a decaſtyle, or had 10 columns in the front, which was to the eaſt. The peribolus or incloſure, which ſurrounded it on the north-eaſt and on the ſouth ſide, meaſures 387 feet in length from north to ſouth, and 328 feet in breadth from eaſt to weſt. On the weſt ſide it joined the angles of the weſt end of the temple in a ſtraight line. Between the weſt wall of the incloſure and temple and the wall of the citadel was a paſſage of 42 feet 6 inches wide, which led to the ſummit of a high rock at the north-weſt angle of the incloſure, on which are viſible the traces of a temple *in antis*, in length 74 feet 6 inches from north to ſouth, and in breadth from the eaſt

Eleutheria. east to the wall of the citadel, to which it joined on the west, 54 feet. It was perhaps that sacred to Triptolemus. This spot commands a very extensive view of the plain and bay. About three-fourths of the cottages are within the precincts of the mystic temple, and the square tower stands on the ruined wall of the inclosure.

"At a small distance from the north end of the inclosure is a heap of marble, consisting of fragments of the Doric and Ionic orders; remains, it is likely, of the temples of Diana Propylea and of Neptune, and of the Propyleum or gateway. Wheler saw some large stones carved with wheat-ears and bundles of poppy. Near it is the bust of a colossal statue of excellent workmanship, maimed, and the face disfigured; the breadth at the shoulders, as measured by Pococke, five feet and an half; and the basket on the head above two feet deep. It probably represented Proserpine. In the heap are two or three inscribed pedestals; and on one are a couple of torches, crossed. We saw another fixed in the same stairs, which lead up the square tower on the outside. It belonged to the statue of a lady, who was hierophant or priestess of Proserpine, and had covered the altar of the goddess with silver. A well in the village was perhaps that called Callichorus, where the women of Eleusis were accustomed to dance in honour of Ceres. A tradition prevails, that if the broken statue be removed, the fertility of the land will cease. Achmet Aga was fully possessed with this superstition, and declined permitting us to dig or measure there, until I had overcome his scruples by a present of a handsome snuff-box containing several zechins or pieces of gold."

ELEUTHERIA, a festival celebrated at Platæa in honour of Jupiter *Eleutherius*, or "the assertor of liberty," by delegates from almost all the cities of Greece. Its institution originated in this: After the victory obtained by the Grecians under Pausanias over Mardonius the Persian general, in the country of Platæa, an altar and statue were erected to Jupiter Eleutherius, who had freed the Greeks from the tyranny of the barbarians. It was further agreed upon in a general assembly, by the advice of Aristides the Athenian, that deputies should be sent every fifth year, from the different cities of Greece, to celebrate Eleutheria, festivals of liberty. The Platæans celebrated also an anniversary festival in memory of those who had lost their lives in that famous battle. The celebration was thus: At break of day a procession was made with a trumpeter at the head, sounding a signal for battle. After him followed chariots loaded with myrrh, garlands, and a black bull, and certain free young men, as no signs of servility were to appear during the solemnity, because they in whose honour the festival was instituted had died in the defence of their country. They carried libations of wine and milk in large-eared vessels, with jars of oil, and precious ointments. Last of all appeared the chief magistrate, who, though not permitted at other times to touch iron, or wear garments of any colour but white, yet appeared clad in purple, and taking a water-pot out of the city-chamber, proceeded through the middle of the town, with a sword in his hand, towards the sepulchres. There he drew water from a neighbouring spring, and washed and anointed the monuments, after which he sacrificed a bull upon a pile of wood, invoking Jupiter and infernal Mercury, and inviting to the entertainment the souls of those happy heroes who had perished in the defence of their country. After this he filled a bowl with wine, saying, I drink to those who lost their lives in the defence of the liberties of Greece. There was also a festival of the same name observed by the Samians in honour of the god of love. Slaves also, when they obtained their liberty, kept a holiday, which they called *Eleutheria*.

Elf || Elginshire

ELF, a term now almost obsolete, formerly used to denote a fairy or hobgoblin; an imaginary being, the creature of ignorance, superstition, and craft. See FAIRY.

Elf-Arrows, in *Natural History*, a name given to the flints anciently fashioned into arrow-heads, and still found fossil in Scotland, America, and several other parts of the world: they are believed by the vulgar to be shot by fairies, and that cattle are sometimes killed by them.

ELGIN, the capital of the county of Moray in Scotland, and formerly a bishop's see, is situated on the river Lossie, about six miles north from the Spey, in W. Long. 2. 25. N. Lat. 57. 40. Mr Pennant says, it is a good town, and has many of the houses built over piazzas; but, excepting its great cattle-fairs, has little trade. It is principally remarkable for its ecclesiastical antiquities. The cathedral, now in ruins, has been formerly a very magnificent pile. The west door is very elegant and richly ornamented. The choir is very beautiful, and has a fine and light gallery running round it; and at the east end are two rows of narrow windows in an excellent Gothic taste. The chapter-house is an octagon; the roof supported by a fine single column with neat carvings of coats of arms round the capital. There is still a great tower on each side of this cathedral; but that in the centre, with the spire and whole roof, are fallen in; and form most awful fragments, mixed with the battered monuments of knights and prelates. Boethius says, that Duncan, who was killed by Macbeth at Inverness, lies buried here. The place is also crowded with a number of modern tomb-stones.—The cathedral was founded by Andrew de Moray, in 1224, on a piece of land granted by Alexander II.; and his remains were deposited in the choir, under a tomb of blue marble, in 1244. The great tower was built principally by John Innes bishop of this see, as appears by the inscription cut on one of the great pillars: "Hic Jacet in Xto, pater et dominus, Dominus *Johannes de Innes*, hujus ecclesiæ Episcopus;—qui hoc notabile opus incepit et per septennium ædificavit." Elgin is a royal borough; and gives title of earl to the family of Bruce.

ELGINSHIRE, is the middle district of the ancient county of Moray. It is bounded on the north by that branch of the German ocean called the *Moray Frith*; on the east and south-east by Banff-shire; on the south-west, by Inverness-shire; and on the west by the counties of Inverness and Nairn. It extends about 42 miles in length, and its average breadth is about 20. The southern part is rocky and mountainous, called the district of *Braemoray*, which is occupied with extensive forests. The lower parts, towards the north, are rich and fertile; but might easily be rendered more

Elginſhire, Eli.

productive. The principal rivers are, the *Spey*, *Findhorne*, and *Loſſie*; all of which abound with ſalmon. It contains two royal boroughs, viz. Elgin, the county town, and Forres; and ſeveral conſiderable towns, as *Grantown*, *Garmouth*, *Loſſiemouth*, &c. The principal ſeats are, *Gordon-caſtle*, the ſeat of the duke of Gordon; *Caſtle Grant*, the ſeat of Sir James Grant; *Altyre*, the ſeat of Colonel Cumming, &c. Morayſhire abounds with many remains of antiquity; the principal of which are the magnificent cathedral of Elgin, the priory of Pluſcardine near the town of Elgin, the biſhop's palace at Spynie, the caſtles of *Lochindorb*, *Dunphail*, and the *dun* of *Relugas*, in the pariſh of Edenkeillie. The ancient Scottiſh hiſtorians, particularly Fordun and Buchanan, give accounts of the Danes landing in Moray, about 1008, when Malcolm II. marched againſt them, and was defeated near Forres: after this they brought over their wives and children, and were in poſſeſſion of the country for ſome time; until they were finally expelled by that monarch, after the victories gained over them at Luncarty near Perth, at Barrie in the county of Angus, and at Mortlach in the county of Banff. There are many monuments of that nation; the moſt remarkable of which is *Sweno's ſtone* or *pillar*, on the road from Nairn and Forres, in the pariſh of Rafford. Except freeſtone, limeſtone, and marl, no mineral ſubſtance of value has been diſcovered.

	Pariſhes.	Population in 1755.	Population in 1790—1798.
1	Alves	1691	1111
	Birnie	525	402
	Dallas	700	888
	Drainy	1174	1040
5	Duffus	1679	1800
	Duthil	1785	1110
	Dyke and Moy	1826	1529
	Edenkeillie	1443	1800
	Elgin	6306	4534
10	Forres	1993	2987
	Kinloſs	1191	1031
	Knockandow	1267	1500
	Rafford	1313	1072
	Rothes	1940	1500
15	St Andrews	1132	777
	Speymouth	994	1347
	Spynie	865	602
18	Urquhart	1110	1050
		28,934	26,080
		26,080	
	Decreaſe,	2854	

ELI, high prieſt of the Iſraelites, and judge over them for forty years, was deſcended from Ithamar, a junior branch of the houſe of Aaron, and ſeems to have blended the prieſtly with the judicial character in the year 1156 before the commencement of the Chriſtian æra. It appears that the Jews were in a ſtate of ſubjection or vaſſalage to the Philiſtines during the greater part of Eli's adminiſtration, and, what may at firſt appear ſingular, he contributed to the degeneracy of his countrymen, although his own piety and goodneſs were unqueſtionably great. He did not exert his magiſterial authority in the exemplary puniſhment of vice, and even permitted his own ſons with impunity to perpetrate the moſt atrocious acts of impiety and debauchery. This want of firmneſs, to give it no worſe a name, was very reprehenſible in one who filled ſuch an important office, and peculiarly ſo in a man who was himſelf a ſaint.

Eli II Elijah.

The celebrated Samſon made his appearance during the adminiſtration of Eli, taking part in the management of public affairs for about twenty years, by whoſe aſtoniſhing deeds the independant ſpirit of that people was in ſome meaſure revived. The circumſtances attending the death of Samſon, which proved ſo calamitous to the nobility of the Philiſtines, might have induced the Jews to throw off the yoke; but they did not poſſeſs a ſufficient degree of virtue and public ſpirit for ſuch an exertion. Eli at this period was very far advanced in years, and, if poſſible, ſtill more negligent in the diſcharge of his duty as a chief magiſtrate, allowing his two ſons, Hophni and Phineas, to proceed to the moſt extravagant height of impiety and debauchery, whoſe example had a moſt powerful influence on the manners of the people. He was far from being unacquainted with their conduct, but he reproved them with ſuch gentleneſs as was highly reprehenſible, and but ill calculated to produce any change on the behaviour of his ſons.

The deity was ſo juſtly offended with this deportment of Eli, that a ſacred ſeer was commiſſioned to upbraid him for his ingratitude and want of reſolution. Young Samuel likewiſe was favoured with a viſion of the approaching ruin of Eli's family, which he related to the otherwiſe venerable old man, on being ſolemnly adjured not to conceal a ſingle circumſtance. When Eli heard the declaration of the young prophet, being fully convinced that his conduct had been highly reprehenſible, he exclaimed, "It is the Lord; let him do what ſeemeth him good." Soon after this the Iſraelites ſuſtained a conſiderable loſs in attempting to procure their emancipation, carrying the ark of God into their camp to animate the people, and intimidate their enemies; but the ark was captured by the Philiſtines, and Hophni and Phineas were ſlain. This intelligence having been brought to Eli, be no ſooner heard that the ark of God was taken, than he fell backwards from his ſeat, broke his neck, and died in the 98th year of his age.

ELIAS, the prophet, memorable for having eſcaped the common cataſtrophe of mankind; being taken up alive into heaven, in a fiery chariot, about 895 B. C. See *the Bible*.

ELIJAH, who is ſometimes denominated Elias, was one of the moſt diſtinguiſhed of the Jewiſh prophets, and ſurnamed the *Tiſbbite*, probably from the diſtrict in which he was born. He began his prophetic office about 920 years before Chriſt, in the reign of wicked Ahab, by whom the Sidonian idolatry was introduced among the Iſraelites. The prophet was commiſſioned to appear before this impious prince, and threaten the country with a long drought as a puniſhment for his crimes. The indignation of Ahab was ſo great againſt the prophet for this prediction, that he reſolved to puniſh him in a ſignal manner; but Elijah withdrew to

Elijah. a ſecret place from his fury, at the divine command, where he was ſuſtained in a miraculous manner. He was afterwards ordered to go to Sarepta, in the territory of Sidon, where a miraculous interpoſition of heaven, in the houſe of an indigent widow, ſuſtained him for ſome time, whoſe ſon the prophet reſtored to life.

When the three years of famine, occaſioned by the drought, were expired, the prophet was ordered to appear before the king, and exhort him to that genuine repentance which an interpoſition of the deity ſo very remarkable unqueſtionably demanded. He had an interview with Obadiah, the governor of the king's houſe, who was a religious man, and had frequently ſcreened many from the vengeance of Jezebel the queen, at the hazard of his own life. Fired with undaunted fortitude, the prophet ſaid to Obadiah, "Go, tell thy lord, behold Elijah is here." The good man's regard for the prophet was ſo great, that he was afraid to deliver this meſſage, ſince he knew that Ahab had uſed every effort to diſcover the prophet's retreat. The king was informed of his coming; and the firſt interview was diſtinguiſhed by invectives on the part of the intrepid prophet and the proud ſovereign, the former giving a promiſe of rain on the following terms. The prieſts of the Sidonian gods, and an aſſembly of the people of Iſrael, were to meet on Mount Carmel, where the prophet Elijah intended to give an inconteſtable proof of the almighty power of the God of Iſrael, and the total inſignificance of the Sidonian divinities. For a detailed account of this memorable experiment, we muſt refer our readers to the book of Kings, as an abridgement of ſuch a beautiful narration would do it manifeſt injury. It produced the fulleſt conviction in the minds of the Iſraelites, that Jehovah alone was entitled to adoration; and the prieſts of Baal were inſtantaneouſly put to death, as the moſt abominable perverters of the divine law.

This was followed by abundance of rain, in anſwer to the devout prayers of the prophet; but his glorious triumph over idolatry ſo exaſperated Jezebel, that ſhe reſolved to murder the prophet, to avoid whoſe rage he fled into the wilderneſs, till the deity again employed him in the honourable, but often hazardous, duties of a prophet. He afterwards foretold that Hazael ſhould be king of Syria, Jehu king over Iſrael; and he appointed Eliſha the ſon of Shaphat to be his own ſucceſſor. He denounced dreadful judgements againſt Ahab and his wicked queen Jezebel; but thoſe which reſpected the king were not executed during his life, on account of the genuine repentance which he diſcovered. The ſucceſſor of Ahab having been confined to bed in conſequence of an accident, the god of Ekron was conſulted relative to his recovery, which induced the prophet to declare that he ſhould aſſuredly die. The king being informed that it was Elijah who dared to ſend ſuch a meſſage, he diſpatched a captain and 50 men to force him into the royal preſence; but they were deſtroyed by fire from heaven, and a ſecond company ſhared the ſame fate. A third company confeſſed the viſible interference of heaven in the prophet's behalf, and the captain throwing himſelf on the mercy of Elijah, went with him to the king. In the royal preſence he undauntedly repeated the ſame denunciation againſt the idolatrous monarch, which was very ſoon accompliſhed; and not long after this the holy prophet, at the divine command, divided aſunder the waves of Jordan, dropped his prophetic mantle to the aſtoniſhed Eliſha, took the flaming chariot commiſſioned for his reception, and rode in majeſty to heaven.

Eliquation || Elis.

ELIQUATION, in *Chemiſtry*, an operation by which a more fuſible ſubſtance is ſeparated from one that is leſs ſo, by means of a heat ſufficiently intenſe to melt the former, but not the latter. Thus an alloy of copper and lead may be ſeparated by a heat capable of melting the latter, but not the former.

ELIS. See ELEA.

ELIS, in *Ancient Geography*, the capital of the diſtrict of that name in Peloponneſus, ſituated on the Peneus, which ran through it. It was the country of Phædo the philoſopher, ſcholar of Socrates, and friend of Plato; who inſcribes with his name the dialogue on the immortality of the ſoul. Pyrrho alſo was of this city, at the head of the ſect called after him *Pyrrhoniſts*.

The city of Elis owed its origin to an union of ſmall towns after the Perſian war. It was not encompaſſed immediately with a wall; for it had the care of the temple at Olympia, and its territory was ſolemnly conſecrated to Jupiter. To invade or not protect it was deemed impiety; and armies, if marching through, delivered up their weapons, which, on their quitting it, were reſtored. Amid warring ſtates the city enjoyed repoſe, was reſorted to by ſtrangers, and flouriſhed. The region round about it was called *cœle* or *hollow*, from the inequalities. The country was reckoned fertile, and particularly fit for the raiſing of flax. This, which grew nowhere elſe in Greece, equalled the produce of Judæa in fineneſs, but was not ſo yellow. Elis was a ſchool, as it were, for Olympia, which was diſtant 37 miles. The athletic exerciſes were performed there, before the more ſolemn trial, in a gymnaſium, by which the Peneus ran. The hellanodics or præfects of the games paired the rival combatants by lot, in an area called *Plethrium* or *The Acre*. Within the wall grew lofty plane-trees; and in the court, which was called the *Xyſtus*, were ſeparate courſes made for the foot-races. A ſmaller court was called the *Quadrangle*. The præfects, when choſen, reſided for ten months in a building erected for their uſe, to be inſtructed in the duties of their office. They attended before ſunriſe to preſide at the races; and again at noon, the time appointed for the pentathlum or five ſports. The horſe were trained in the agora or market-place, which was called the *Hippodrome*. In the gymnaſium were altars and a cenotaph of Achilles. The women, beſides other rites, beat their boſoms in honour of this hero, on a fixed day toward ſunſet. There alſo was the town-hall, in which extemporary harangues were ſpoken and compoſitions recited. It was hung round with bucklers for ornaments. A way led from it to the baths through the Street of Silence; and another to the market-place, which was planned with ſtreets between porticoes of the Doric order adorned with altars and images. Among the temples, one had a circular periſtyle or colonnade; but the image had been removed and the roof was fallen in the time of Pauſanias. The theatre was ancient, as was alſo a temple of Bacchus, one of the deities principally adored at Elis. Minerva had a temple in the citadel, with an image of ivory and gold, made

Eliſha || Elizabeth.

(it was ſaid) by Phidias. At the gate leading to Olympia was the monument of a perſon, who was buried, as an oracle had commanded, neither within nor without the city. The ſtructures of Elis, Dr Chandler obſerves, ſeem to have been raiſed with materials far leſs elegant and durable than the produce of the Ionian and Attic quarries. The ruins are of brick, and not conſiderable, conſiſting of pieces of ordinary wall, and an octagon building with niches, which, it is ſuppoſed, was the temple with a circular periſtyle. Theſe ſtand detached from each other, ranging in a vale ſouthward from the wide bed of the river Peneus; which, by the margin, has ſeveral large ſtones, perhaps relicks of the gymnaſium. The citadel was on a hill, which has on the top ſome remnants of a wall.

ELISHA the prophet, famous for the miracles he performed, died about 830 B. C. See *the Bible*.

ELISION, in *Grammar*, the cutting off or ſuppreſſing a vowel at the end of a word, for the ſake of ſound or meaſure, the next word beginning with a vowel.

Eliſions are pretty frequently met with in Engliſh poetry, but more frequently in the Latin, French, &c. They chiefly conſiſt in ſuppreſſions of the *a*, *e*, and *i*, though an eliſion ſuppreſſes any of the other vowels.

ELIXATION, in *Pharmacy*, the extracting the virtues of ingredients by boiling or ſtewing.

ELIXIR, in *Medicine*, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir ſeems to be this, that a tincture is drawn from one ingredient, ſometimes with an addition of another to open it and to diſpoſe it to yield to the menſtruum; whereas an elixir is a tincture extracted from ſeveral ingredients at the ſame time.

ELIZABETH, queen of England, daughter of Henry VIII. and Anne Boleyn, was born at Greenwich, September 7. 1553. According to the humour of the times, ſhe was early inſtructed in the learned languages, firſt by Grindal, who died when ſhe was about 17, and afterwards by the celebrated Roger Aſcham. She acquired likewiſe conſiderable knowledge of the Italian, Spaniſh, and French languages. Dr Grindal was alſo her preceptor in divinity, which ſhe is ſaid to have ſtudied with uncommon application and induſtry. That Elizabeth became a Proteſtant, and her ſiſter Mary a Papiſt, was the effect of that cauſe which determines the religion of all mankind; namely, the opinion of thoſe by whom they were educated: and this difference of opinion, in their tutors, is not at all ſurpriſing, when we recollect, that their father Harry was of both religions, or of neither.

But the ſtudies of Elizabeth were not confined merely to languages and theology: ſhe was alſo inſtructed in the political hiſtory of the ancients; and was ſo well ſkilled in muſic, as to ſing and play "artfully and ſweetly."

After the ſhort reign of her brother Edward, our heroine being then about 20 years of age, her *firebrand* ſiſter acceding to the crown, Elizabeth experienced a conſiderable degree of perſecution, ſo as to be not a little apprehenſive of a violent death. She was accuſed of nobody knows what; impriſoned; and, we are told, inhumanly treated. At laſt, by the interceſſion of King Philip of Spain, ſhe was ſet at liberty; which ſhe continued to enjoy, till, on the death of her *pious* ſiſter, ſhe, on the 17th of November 1558, aſcended the throne of England. Her political hiſtory as a queen, is univerſally known and admired *: but her attention to the government of her kingdom did not totally ſuſpend her purſuit of learning. Aſcham, in his *Schoolmaſter*, tells us, that, about the year 1563, five years after her acceſſion, ſhe being then at Windſor, beſides her perfect readineſs in Latin, Italian, French, and Spaniſh, ſhe read more Greek in one day than ſome prebendaries of that church did read Latin in a whole week, (p. 21.)—She employed Sir John Forteſcue to read to her Thucydides, Xenophon, Polybius, Euripides, Æſchines, and Sophocles. (*Ballard*, p. 219.)—That the Latin language was familiar to her, is evident from her ſpeech to the univerſity of Oxford, when ſhe was near ſixty; alſo from her ſpirited anſwer to the Poliſh ambaſſador in the year 1598. And that ſhe was alſo ſkilled in the art of poetry, appears not only from the ſeveral ſcraps which have been preſerved, but likewiſe from the teſtimony of a contemporary writer, Puttenham, in his *Art of Engl. Poetry* (a very ſcarce book.) Theſe are his words:—"But, laſt in recital, "and firſt in degree, is the queen, whoſe learned, de- "licate, noble muſe, eaſily ſurmounteth all the reſt, "for ſenſe, ſweetneſs, or ſubtility, be it in ode, elegy, "epigram, or any other kind of poem," &c. In this author are to be found only a ſpecimen of 16 verſes of her Engliſh poetry. "But," ſays Mr Walpole, "a "greater inſtance of her genius, and that too in La- "tin, was her extempore reply to an inſolent prohibi- "tion delivered to her from Philip II. by his ambaſſa- "dor, in this tetraſtic.

Te veto ne pergas bello defendere Belgas:
Quæ Dracus eripuit, nunc reſtituantur oportet:
Quas pater evertit, jubeo te condere cellas:
Religio papæ fac reſtituatur ad unguem.

"She inſtantly anſwered him, with as much ſpirit as ſhe uſed to return his invaſions;

Ad Græcas, bone rex, fient mandata kalendas."

Being earneſtly preſſed by a Romiſh prieſt, during his perſecution, to declare her opinion concerning the real preſence of Chriſt's body in the wafer, ſhe anſwered,

Chriſt was the word that ſpake it;
He took the bread, and brake it:
And what that word did make it,
That I believe, and take it. *Fuller's Holy State.*

She gave the characters of four knights of Nottinghamſhire in the following diſtich:

Gervaſe the gentle, Stanhope the ſtout,
Markham the lion, and Sutton the lout. *Walp. Cat.*

Coming into a grammar-ſchool, ſhe characterized three claſſic authors in his hexameter:

Perſius a crab-ſtaff; bawdy Martial; Ovid a fine wag.
Full. Worth. of Warw. 126.

Sir

Elizabeth.

*See (Hiſtory of *England*.

Elizabeth.

Sir Walter Raleigh having wrote on a window,

Fain would I climb, yet fear I to fall;

She immediately wrote under it,

If thy heart fail thee, climb not at all.

Worth. of Devonſh. 261.

Doubtleſs, ſhe was a woman of ſingular capacity and extraordiary acquirements: and, if we could forget the ſtory of the Scottiſh Mary, and of her favourite Eſſex, together with the burning of a few Anabaptiſts; in ſhort, could we forbear to contemplate her character through the medium of religion and morality, we might pronounce her the moſt illuſtrious of illuſtrious women. See further the articles ENGLAND, MARY, and SCOTLAND. She died in her palace at Richmond, the 24th of March 1602, aged 70, having reigned 44 years; and was interred in the chapel of Henry VII. in Weſtminſter Abbey. Her ſucceſſor James erected a magnificent monument to her memory. —She wrote, 1. The Mirror, or Glaſs of the Sinful Soul. This was tranſlated out of French verſe into Engliſh proſe, when ſhe was eleven years old. It was dedicated to Queen Catharine Parr. Probably it was never printed; but the dedication and preface are preſerved in the *Sylloge epiſtolarum*, in Hearne's edition of *Livii Foro-Julienſis*, p. 161. 2. Prayers and Meditations, &c. Dedicated to her father, dated at Hatfield, 1545. Manuſcript, in the royal library. 3. A Dialogue out of Xenophon, in Greek, between Hiero a King, yet ſome time a private perſon, and Simonides a Poet, as touching the life of the Prince and Private Man. Firſt printed, from a manuſcript in her majeſty's own hand-writing, in the Gentleman's Magazine for 1743. 4. Two Orations of Iſocrates, tranſlated into Latin. 5. Latin Oration at Cambridge. Preſerved in the king's library: alſo in Hollinſhed's Chron. p. 1206; and in Fuller's Hiſt. of Cambr. p. 138. 6. Latin Oration at Oxford. See Wood's Hiſt. and Antiq. of Oxf. lib. i. p. 289. alſo in Dr Jebb's Append. to his Life of Mary Queen of Scots. 7. A comment on Plato. 8. *Boethius de conſolatione philoſophiæ*, tranſlated into Engliſh anno 1593. 9. *Salluſt de bello Jugurthino*, tranſlated into Engliſh anno 1590. 10. A play of Euripides, tranſlated into Latin, (Cat. of Royal Auth.). 11. A Prayer for the uſe of her fleet in the great expedition in 1596. 12. Part of Horace's Art of Poetry, tranſlated into Engliſh anno 1598. 13. *Plutarch de curioſitate*, tranſlated into Engliſh. 14. Letters on various occaſions to different perſons: ſeveral ſpeeches to her parliament; and a number of other pieces.

ELIZABETH PETROWNA, (daughter of Peter the Great), the laſt empreſs of Ruſſia, diſtinguiſhed herſelf by her ſignal clemency. She made a vow, that no perſon ſhould be put to death in her reign, and ſhe ſtrictly obſerved it. The example was followed, and confirmed by law, under the auguſt ſovereign of Ruſſia, Catharine II. Elizabeth died in 1762, in the 21ſt year of her reign and 52d of her age. Elizabeth || Elliot.

ELK, in *Zoology*. See CERVUS, MAMMALIA *Index*.

ELL, (*ulna*,) a meaſure, which obtains, under different denominations, in moſt countries, whereby cloths, ſtuffs, linens, ſilks, &c. are uſually meaſured; anſwering nearly to the yard of England, the canna of Italy, the vara of Spain, the palm of Sicily, &c.

Servius will have the ell to be the ſpace contained between the two hands when ſtretched forth; but Suetonius makes it only the cubit.

The ells moſt frequently uſed with us are the Engliſh and Flemiſh; the former containing three feet nine inches, or one yard and a quarter; the latter only 27 inches, or three quarters of a yard; ſo that the ell Engliſh is to the Flemiſh ell as five to three. In Scotland, the ell contains $37\frac{2}{10}$ Engliſh inches.

M. Ricard, in his Treatiſe of Commerce, reduces the ells thus: 100 ells of Amſterdam are equal to $98\frac{3}{4}$ of Brabant, Antwerp, and Bruſſels; to $58\frac{1}{2}$ of England and France; to 122 of Hamburgh, Francfort, Leipſic, and Cologne; 125 of Breſlaw; 110 of Bergen and Drontheim; and 117 of Stockholm.

ELLIOT, the Right Honourable George Auguſtus, Lord Heathfield, was the youngeſt ſon of the late Sir Gilbert Elliot, Baronet, of Stobbs (A) in Roxburghſhire; and was born about the year 1718. He received the firſt rudiments of his education under a private tutor: and at an early time of life was ſent to the univerſity of Leyden, where he made conſiderable progreſs in claſſical learning, and ſpoke with fluency and elegance the German and French languages. Being deſigned for a military life, he was ſent from thence to the celebrated *Ecole Royale du Genie Militaire*, conducted by the great Vauban, at La Fere in Picardy; where he laid the foundation of what he ſo conſpicuouſly exhibited at the defence of Gibraltar. He completed his military courſe on the continent by a tour, for the purpoſe of ſeeing in practice what he had ſtudied in theory. Pruſſia was the model for diſcipline, and he continued ſome time as a volunteer in that ſervice.

Mr Elliot returned in the 17th year of his age to his native country, Scotland; and was the ſame year, 1735, introduced by his father Sir Gilbert to Lieutenant-Colonel Peers of the 23d regiment of foot, then lying at Edinburgh, as a youth anxious to bear arms for

(A) The ancient and honourable family of Elliot of Stobbs, as well as the collateral branch of Elliot of Minto in the ſame county, and of Elliot of Port-Elliot in Cornwall, are originally from Normandy. Their anceſtor, Mr Aliott, came over with William the Conqueror, and held a diſtinguiſhed rank in his army. There is a traditionary anecdote in the family relating to an honourable diſtinction in their coat, which, as it correſponds with hiſtory, bears the probability of truth. When William ſet foot on Engliſh land, he ſlipped and fell on the earth. He ſprung up, and exclaimed that it was a happy omen—he had embraced the country of which he was to become the lord. Upon this Aliott drew his ſword, and ſwore by the honour of a ſoldier, that he would maintain, at the hazard of his blood, the right of his lord to the ſovereignty of the earth which he had embraced. On the event of the conqueſt, King William added to the arms of Aliott, which was a baton *er*, on a field *azure*, an arm and ſword as a creſt, with the motto, *Per ſaxa, per ignes, fortiter et rectè*.

Elliot. for his king and country. He was accordingly entered as a volunteer in that regiment, where he continued for a year or more. From the 23d regiment he went into the engineer corps at Woolwich, and made great progreſs in that ſtudy, until his uncle Colonel Elliot brought him in his adjutant of the ſecond troop of horſe grenadiers. With theſe troops he went upon ſervice to Germany, and was with them in a variety of actions. At the battle of Dettingen he was wounded. In this regiment he bought the rank of captain and major, and afterwards purchaſed the lieutenant-colonelcy from Colonel Brewerton, who ſucceeded to his uncle. On arriving at this rank, he reſigned his commiſſion as an engineer, which he had enjoyed along with his other rank, and in which ſervice he had been actively employed very much to the advantage of his country. He received the inſtructions of the famous engineer Bellidor, and made himſelf completely maſter of the ſcience of gunnery. Had he not ſo diſintereſtedly reſigned his rank in the engineer department, he would long before his death, by regular progreſſion, have been at the head of that corps. Soon after this he was appointed aid-de camp to George II. and was diſtinguiſhed for his military ſkill and diſcipline. In the year 1759, he quitted the ſecond troop of horſe grenadier guards, being ſelected to raiſe, form, and diſcipline, the firſt regiment of light horſe, called after him *Elliot's*. As ſoon as they were raiſed and formed, he was appointed to the command of the cavalry in the expedition on the coaſts of France, with the rank of brigadier general. After this he paſſed into Germany, where he was employed on the ſtaff, and greatly diſtinguiſhed himſelf in a variety of movements; where his regiment diſplayed a ſtrictneſs of diſcipline, an activity and enterpriſe, which gained them ſignal honour: and indeed they have been the pattern regiment, both in regard to diſcipline and appointment, to the many light dragoon troops that have been ſince raiſed in our ſervice. From Germany he was recalled for the purpoſe of being employed as ſecond in command in the memorable expedition againſt the Havannah; the circumſtances of which conqueſt are well known.

On the peace, his gallant regiment was reviewed by the king, when they preſented to his majeſty the ſtandards which they had taken from the enemy. Gratified with their fine diſcipline and high character, the king aſked General Elliot what mark of his favour he could beſtow on his regiment equal to their merit? He anſwered, that his regiment would be proud if his majeſty ſhould think, that, by their ſervices, they were entitled to the diſtinction of *Royals*. It was accordingly made a royal regiment, with this flattering title, "The 15th, or *King's* Royal Regiment of Light Dragoons." At the ſame time the king expreſſed a deſire to confer ſome honour on the general himſelf; but the latter declared, that the honour and ſatisfaction of his majeſty's approbation of his ſervices was his beſt reward.

During the peace he was not idle. His great talents in the various branches of the military art gave him ample employment. In the year 1775, he was appointed to ſucceed General A'Court as commander in chief of the forces in Ireland; but did not continue long in this ſtation, not even long enough to unpack all his trunks; for finding that interferences were made by petty authority derogatory of his own, he reſiſted the practice with becoming ſpirit; and not chooſing to diſturb the government of the ſiſter kingdom on a matter perſonal to himſelf, he ſolicited to be recalled. He accordingly was ſo, and appointed to the command of Gibraltar in a fortunate hour for the ſafety of that important fortreſs. The ſyſtem of his life, as well as his education, peculiarly qualified him for this truſt. He was perhaps the moſt abſtemious man of the age; neither indulging himſelf in animal food nor wine. He never ſlept more than four hours at a time; ſo that he was up later and earlier than moſt other men. He ſo inured himſelf to habits of hardineſs, that the things which are difficult and painful to other men, were to him his daily practice, and rendered pleaſant by uſe. It could not be eaſy to ſtarve ſuch a man into a ſurrender, nor poſſible to ſurpriſe him. The example of the commander in chief in a beſieged garriſon had a moſt perſuaſive efficacy in forming the manners of the ſoldiery. Like him his brave followers came to regulate their lives by the moſt ſtrict rules of diſcipline before there aroſe a neceſſity for ſo doing; and ſevere exerciſe, with ſhort diet, became habitual to them by their own choice. The military ſyſtem of diſcipline which he introduced, and the preparations which he made for his defence, were contrived with ſo much judgment, and executed with ſo much addreſs, that he was able with a handful of men to preſerve his poſt againſt an attack, the conſtancy of which, even without the vigour, had been ſufficient to exhauſt any common ſet of men. Collected within himſelf, he in no inſtance deſtroyed, by premature attacks, the labours which would coſt the enemy time, patience, and expence to complete; he deliberately obſerved their approaches, and ſeized on the proper moment, with the keeneſt perſpection, in which to make his attack with ſucceſs. He never ſpent his ammunition in uſeleſs parade or in unimportant attacks. He never relaxed from his diſcipline by the appearance of ſecurity, nor hazarded the lives of his garriſon by wild experiments. By a cool and temperate demeanour, he maintained his ſtation for three years of conſtant inveſtment, in which all the powers of Spain were employed. All the eyes of Europe were on this garriſon; and his conduct has juſtly exalted him to the moſt elevated rank in the military annals of the day. On his return to England, the gratitude of the Britiſh ſenate was as forward as the public voice in giving him that diſtinguiſhed mark his merit deſerved. Both houſes of parliament voted an unanimous addreſs of thanks to the general. The king conferred on him the honour of Knight of the Bath, with a penſion during his own and a ſecond life of his own appointment; and on June 14. 1787, his majeſty advanced him to the peerage, by the title of *Lord Heathfield, Baron Gibraltar*, permitting him to take, in addition to his family arms, the arms of the fortreſs he had ſo bravely defended, to perpetuate to futurity his noble conduct. Elliot.

His lordſhip died on the 6th of July 1790, at his chateau at Aix-la-Chapelle, of a ſecond ſtroke of the palſy, after having for ſome weeks preceding enjoyed tolerable good health and an unuſual flow of ſpirits. His death happened two days before he was to have ſet out for Leghorn in his way to Gibraltar; of which place he was once more appointed to the de-

fence,

Ellipomacrostyla || Elmacinus.

fence, in the view of an approaching war.—He married Anne, daughter of Sir Francis Drake of Devonſhire; and had by her (who died in 1769) Francis-Auguſtus, now Lord Heathfield, lieutenant-colonel of the 6th regiment of horſe.

ELLIPOMACROSTYLA, an old term, in *Natural Hiſtory*, from the Greek, ελλιπης *imperfect*, μακρος *long*, and στυλος *a column*; which expreſſes an imperfect cryſtal with a long column, one end of the column being affixed to ſome ſolid body, and compoſed of thin and ſlender hexangular columns, terminated by hexangular pyramids.

ELLIPOPACHYSTYLA, an old term, in *Natural Hiſtory*, derived from the Greek, ελλιπης *imperfect*, παχυς *thick*, and στυλος *a column*, and expreſſes a cryſtal of the imperfect kind with a thick column.

ELLIPSIS, in *Geometry*, a curve line returning into itſelf, and produced from the ſection of a cone by a plane cutting both its ſides, but not parallel to the baſe. See *Conic Sections*.

ELLIPSIS, in *Grammar*, a figure of ſyntax, wherein one or more words are not expreſſed; and from this deficiency it has got the name *ellipſis*.

ELLIPTIC, or ELLIPTICAL, ſomething belonging to an ellipſis.

ELLISIA, a genus of plants belonging to the pentandria claſs; and in the natural method ranking under the 28th order, *Luridæ*. See BOTANY *Index*.

ELLYS, DR ANTHONY, who was born in 1693, and educated at Clarehall, Cambridge, after riſing through many inferior degrees of dignity in the church of England, was, in 1752, promoted to the ſee of St David's. He died at Glouceſter in 1761, and is mentioned here only for the ſake of his works, which are leſs known than they ſhould in the preſent time of novel opinions. They are, beſides occaſional ſermons, 1. A Plea for the Sacramental Teſt, as a juſt ſecurity to the Church eſtabliſhed, and very conducive to the welfare of the State. 2. Remarks on Hume's Eſſay on Miracles. 3. Tracts on the Liberty ſpiritual and temporal of Proteſtants in England, addreſſed to J. N. Eſq; at Aix-la Chapelle; the firſt part of which was printed in 1763, the ſecond in 1765. In theſe tracts, as the editors of them truly obſerve, he "diſcovers not only fine parts, extenſive knowledge, and ſound judgement, but a heart overflowing with benevolence and candour, and a moſt Chriſtian temper: for he always thought a perſon, though on the right ſide of the queſtion, with principles of perſecution, to be a worſe man than he that was on the wrong." This amiable and reſpectable writer affords in his own conduct a proof that a man may be ſteadily attached to a party, without wiſhing to encroach upon the rights of others.

ELM. See ULMUS, BOTANY *Index*.

ELMACINUS, GEORGE, author of a *Hiſtory of the Saracens*, was born in Egypt towards the middle of the 13th century. His hiſtory comes down from Mahomet to the year of the Hegira 512, anſwering to the year of our Lord 1134; in which he ſets down year by year, in a very conciſe manner, whatever regards the Saracen empire, intermixed with ſome paſſages relating to the eaſtern Chriſtians. His abilities muſt have been conſiderable; ſince, though he profeſſed Chriſtianity, he held an office of truſt near the perſons of the Mahometan princes. He was ſon to Yaſer Al Amid, ſecretary to the council of war under the ſultans of Egypt for 45 years; and in 1238, when his father died, ſucceeded him in his place. His hiſtory of the Saracens was tranſlated from Arabic into Latin by Erpinius: and printed in theſe two languages in folio, at Leyden, in 1625. Erpinius died before the publication; but Golius took care of it, and added a preface. It was dedicated by Erpinius's widow to Dr Andrews, biſhop of Wincheſter.

Elocution || Elphinſton.

ELOCUTION. See ORATORY, Part III.

ELOGY, a praiſe or panegyric beſtowed on any perſon or thing, in conſideration of its merit. The beauty of elogy conſiſts in an expreſſive brevity. Eulogiums ſhould not have ſo much as one epithet, properly ſo called, nor two words ſynonymous: they ſhould ſtrictly adhere to truth: for extravagant and improbable elogies rather leſſen the character of the perſon or thing they would extol.

ELOHI, ELOI, or *Elohim*, in ſcripture, one of the names of God. But it is to be obſerved, that angels, princes, great men, judges, and even falſe gods, are ſometimes called by this name. The ſequel of the diſcourſe is what aſſiſts us in judging rightly concerning the true meaning of this word. It is the ſame as *Eloha*. One is the ſingular, the other the plural. Nevertheleſs *Elohim* is often conſtrued in the ſingular number, particularly when the true God is ſpoken of: but when falſe gods are ſpoken of, it is conſtrued rather in the plural.

ELOINED, in *Law*, ſignifies reſtrained or hindered from doing ſomething: thus it is ſaid, that if thoſe within age be eloined, ſo that they cannot ſue perſonally, their next friend ſhall ſue for them.

ELONGATION, in *Aſtronomy*, the digreſſion or receſs of a planet from the ſun, with reſpect to an eye placed on our earth. The term is chiefly uſed in ſpeaking of Venus or Mercury, the arch of a great circle intercepted between either of theſe planets and the ſun being called the *elongation* of that planet from the ſun.

ELONGATION, in *Surgery*, is an imperfect luxation, occaſioned by the ſtretching or lengthening of the ligaments of any part.

ELOPEMENT, in *Law*, is where a married woman departs from her huſband, and cohabits with an adulterer; in which caſe the huſband is not obliged to allow her any alimony out of her eſtate, nor is he chargeable for neceſſaries for her of any kind. However, the bare advertiſing a wife in the gazette, or other public paper, is not a legal notice to perſons in general not to truſt her; though a perſonal notice given by the huſband to particular perſons is ſaid to be good.—An action lies, and large damages may be recovered, againſt a perſon for carrying away and detaining another man's wife.

ELOQUENCE, the art of ſpeaking well, ſo as to affect and perſuade. See ORATORY.

ELPHINSTON, WILLIAM, a Scotch prelate and ſtateſman of conſiderable eminence, who flouriſhed in the end of the 15th and commencement of the 16th century, was born at Glaſgow in the year 1431. At the univerſity of this city he received his education, and in the learning which diſtinguiſhed that period he made extraordinary proficiency. His ſtudies being completed, he went over to France, to make himſelf maſter

of

Elphinſton || Elſimburg.

of the civil and canon law in the univerſity of Paris, where he afterwards became a profeſſor, and for the ſpace of ſix years acquired conſiderable reputation in the diſcharge of his duty. On his return to Scotland, he entered into holy orders, was ſoon appointed official of Glaſgow, and afterwards of St Andrews. He was admitted a member of the king's council; and on a miſunderſtanding taking place between James III. of Scotland and Louis XI. of France, his powerful mediation at the latter court, in conjunction with the biſhop of Dunkeld and the earl of Buchan, effected an amicable reconciliation. As Elphinſton on this occaſion diſplayed ſuch prudence and eloquence, the king was ſo grateful for his meritorious ſervices, that he rewarded him with the ſee of Roſs, from which he was tranſlated to the dioceſe of Aberdeen about the year 1484, and alſo appointed to the high office of chancellor of the kingdom, which he managed with ſo much moderation and equity, that all parties eſteemed and admired him. When the civil wars broke out between James and the diſcontented nobility, Biſhop Elphinſton appears to have declined all interference with public affairs of a political nature, and confined himſelf to the diſcharge of his miniſterial duties. But when James IV. aſcended the throne, his abilities as a ſtateſman were again called forth, and he was choſen ambaſſador to the emperor Maximilian, in order to bring about a marriage alliance between his royal maſter and the emperor's daughter; but ſhe had been previouſly promiſed to another. Yet the biſhop's miſſion was not without its ſalutary effects, as he was the mean of terminating an enmity which had long exiſted between the Dutch and Scots. This he conducted in ſuch a maſterly manner, that James never undertook any thing of importance, without firſt procuring the ſanction of his approbation. He was equally the zealous patron of learning; and it is generally believed that the eſtabliſhment of a univerſity at Aberdeen was entirely owing to his influence with the Pope, from whom he obtained a bull for that purpoſe; and by his exertions was King's college undertaken and completed. He bequeathed, at the time of his deceaſe, large ſums of money for its ſupport. He terminated his mortal career in 1514, about 83 years of age, at which advanced period his conſtitutional vigour was very little impaired, and all the faculties of his mind were in full force; but the ſerious loſſes at the memorable battle of Flowden had broken his heart. He wrote a hiſtory of his native country, which is among the manuſcripts of Sir Thomas Fairfax, in the Bodleian library at Oxford.

EDSHEMIER, Adam, a celebrated painter, born at Francfort on the Maine, in 1574. He was firſt a diſciple of Philip Uffenbach, a German; but his deſire of improvement carrying him to Rome, he ſoon became a moſt excellent artiſt in landſcapes, hiſtory, and night-pieces, with ſmall figures. His works are but few; and the great pains he beſtowed in finiſhing them raiſed their prices ſo high, that they are hardly anywhere to be found but in the cabinets of princes. He was of a melancholy turn, and ſunk under the embaraſſments of his circumſtances in 1610. James Erneſt Thomas of Landau was his diſciple; and imitated his ſtyle ſo nicely, that their performances are not eaſily diſtinguiſhed.

ELSIMBURG, a port town of Sweden, in the province of Gothland, and territory of Schonen, ſeated on the ſide of the Sound, over againſt Elſinore. It was formerly a fortreſs belonging to the Danes; but all the fortifications were demoliſhed in 1679, and there is only one tower of a caſtle which remains undemoliſhed. It now belongs to Sweden. E. Long. 13. 20. N. Lat. 56. 2.

Elſinore, Elvas.

ELSINORE, or Elsinoor, a port town of Denmark, ſeated on the Sound, in the iſle of Zealand. E. Long. 13. 23. N. Lat. 56. 0.—It was a ſmall village, containing a few fiſhermen's huts, until 1445, when it was made a ſtaple town by Eric of Pomerania; who conferred upon the new ſettlers conſiderable immunities, and built a caſtle for their defence. From that period it gradually increaſed in ſize and wealth, and is now the moſt commercial place in Denmark next to Copenhagen. It contains about 5000 inhabitants, amongſt whom are a conſiderable number of foreign merchants, and the conſuls of the principal nations trading to the Baltic. The paſſage of the Sound is guarded by the fortreſs of Cronborg, which is ſituated upon the edge of a peninſular promontory, the neareſt point of land from the oppoſite coaſt of Sweden. It is ſtrongly fortified towards the ſhore by ditches, baſtions, and regular entrenchments; and towards the ſea by ſeveral batteries, mounted with 60 cannon, the largeſt whereof are 48 pounders. Every veſſel, as it paſſes, lowers her top-ſails, and pays a toll at Elſinore. It is generally aſſerted, that this fortreſs guards the Sound; and that all the ſhips muſt, on account of the ſhoal waters and currents, ſteer ſo near the batteries as to be expoſed to their fire in caſe of refuſal. This, however, is a miſtaken notion. On account indeed of the numerous and oppoſite currents in the Sound, the ſafeſt paſſage lies near the fortreſs; but the water in any part is of ſufficient depth for veſſels to keep at a diſtance from the batteries, and the largeſt ſhips can even ſail cloſe to the coaſt of Sweden. The conſtant diſcharge, however, of the toll, is not ſo much owing to the ſtrength of the fortreſs as to a compliance with the public law of Europe. Many diſputes have ariſen concerning the right by which the crown of Denmark impoſes ſuch a duty. The kings of Sweden, in particular, claiming an equal title to the free paſſage of the Strait, were for ſome time exempted by treaty from paying it; but in 1720, Frederic I. agreed that all Swediſh veſſels ſhould for the future be ſubject to the uſual impoſts. All veſſels, beſide a ſmall duty, are rated at 1¼ per cent. of their cargoes, except the Engliſh, French, Dutch, and Swediſh, which pay only one per cent; and in return the crown takes the charge of conſtructing light-houſes, and erecting ſignals to mark the ſhoals and rocks, from the Categate to the entrance into the Baltic. The tolls of the Sound, and of the two Belts, ſupply an annual revenue of above 100,000l.

ELVAS, a large town, and one of the beſt and moſt important in Portugal, ſeated in the province of Alentejo, a few miles from the frontiers of Eſtremadura in Spain. It is built on a mountain, and is ſtrongly fortified with works of free-ſtone. The ſtreets of the town are handſome, and the houſes neat; and there is a ciſtern ſo large, that it will hold water enough to ſupply the whole town ſix months. The water is conveyed to it by a magnificent aqueduct, three

Eluding || Ely.

three miles in length, ſuſtained in ſome places by four or five high arches, one upon another. It was bombarded by the French and Spaniards in 1706, but without effect. It has generally a garriſon of 1000 men. The king founded an academy here, in 1733, for young gentlemen. W. Long. 7. 28. N. Lat. 38. 39.

ELUDING, the act of evading or rendering a thing vain and of no effect; a dexterous getting clear, or eſcaping out of an affair, difficulty, embarraſſment, or the like. We ſay, to *elude* a propoſition, &c. The deſign of chicanery is, to *elude* the force of the laws: This doctor has not reſolved the difficulty, but *eluded* it. Alexander, ſays the hiſtorian, in cutting the Gordian knot, either *eluded* the oracle or fulfilled it: *Ille nequicquam luctatus cum latentibus nodis, Nihil, inquit, intereſt, quomodo ſolvatur; gladioque ruptis omnibus loris, oraculi ſortem vel* eludit, *vel implevit.*

ELVELA, a genus of plants belonging to the cryptogamia claſs, and order of fungi. The fungus is turbinated, or like an inverted cone. See BOTANY *Index.*

ELUL, in ancient chronology, the 12th month of the Jewiſh civil year, and the ſixth of the eccleſiaſtical: it conſiſted of only 29 days, and anſwered pretty nearly to our Auguſt.

ELUTRIATION, in *Chemiſtry*, an operation performed by waſhing ſolid ſubſtances with water, ſtirring them well together, and haſtily pouring off the liquid, while the lighter part remains ſuſpended in it, that it may thereby be ſeparated from the heavier part. By this operation metallic ores are ſeparated from earth, ſtones, and other unmetallic particles adhering to them.

ELY, a city and biſhop's ſee of Cambridgeſhire, ſituated about 12 miles north of Cambridge. E. Long. 0. 51. N. Lat. 52. 24. It is a county of itſelf, including the territory around; and has a judge who determines all cauſes civil and criminal within its limits. The church hath undergone various alterations ſince it was firſt eſtabliſhed by Etheldra, the wife of Egfride, king of Northumberland, who founded a religious houſe here, and planted it with virgins, and became the firſt abbeſs of it herſelf. The Danes entirely ruined this eſtabliſhment; then Ethelwald, the 27th biſhop of Wincheſter, rebuilt the monaſtery, and filled it with monks; to whom King Edgar, and many ſucceeding monarchs, beſtowed many privileges, and great grants of land; ſo that this abbey became in proceſs of time the beſt of any in England. Richard, the 11th abbot, wiſhing to free himſelf of the biſhop of Lincoln, within whoſe dioceſe his monaſtery was ſituated, and not liking ſo powerful a ſuperior, he made great intereſt with King Henry I. to get Ely erected into a biſhoprick; and ſpared neither purſe nor prayers to bring this about. He even brought the biſhop of Lincoln to conſent to it, by giving him and his ſucceſſors the manors of Bugden, Biggleſwade, and Spalding, which belonged to the abbey, in lieu of his juriſdiction; but he lived not to taſte the ſweets of his induſtry and ambition, he dying before his abbey was erected into a ſee. His ſucceſſor was the firſt biſhop of Ely: but the great privileges the biſhop enjoyed were almoſt wholly taken away, or much reſtricted, by the act of parliament, 27th Henry VIII. regarding the reſtoring to the crown the ancient royalties: So, inſtead of being palatine of the iſle of Ely, the biſhop and his temporal ſteward were by that act declared to be from thenceforth juſtices of the peace in the ſaid iſland. This dioceſe contains all Cambridgeſhire, and the iſle of Ely, excepting Iſelham, which belongs to the ſee of Rocheſter, and 15 other pariſhes, that are in the dioceſe of Norwich; but it has a pariſh in Norfolk, viz. Emneth. The number of pariſhes in this dioceſe are 141, whereof 75 are impropriate. It hath but one archdeacon, viz. of Ely. It is valued in the king's books at 2134l. 18s 5d. The clergy's tenth amounting to the ſum of 384l. 14s. 9½d. The biſhopric is computed to be worth annually 4000l. The church is dedicated to St Ethelred. The building, as it now appears, has been the work of ſeveral of its biſhops. The weſt parts were rebuilt by Biſhop Ridal; the choir and lanthern were begun by Biſhop Norwold, and finiſhed by Biſhop Frodiham. This ſee hath given two ſaints and two cardinals to the church of Rome; and to the Engliſh nation nine lord chancellors, ſeven lord treaſurers, one lord privy ſeal, one chancellor of the exchequer, one chancellor to the univerſity of Oxford, two maſters of the rolls, and three almoners. To this cathedral belong a biſhop, a dean, an archdeacon, eight prebendaries, with vicars, lay-clerks, choriſters, a ſchoolmaſter, uſher, and 28 king's ſcholars.

Elymais || Elyſium.

ELYMAIS, the capital city of the land of Elam, or the ancient Perſia. We are told (1 Mac. vi. 1.) that Antiochus Epiphanes, having underſtood that there were very great treaſures lodged in a temple at Elymais, determined to go and plunder it: but the citizens getting intelligence of his deſign, made an inſurrection, forced him out of the city, and obliged him to fly. The author of the ſecond book of Maccabees (ix. 2.) calls this city *Perſepolis*, in all probability becauſe formerly it was the capital of Perſia; for it is known from other accounts, that Perſepolis and Elymais were two very different cities, the latter ſituated upon the Eulæus, the former upon the Araxis.

ELYMUS, a genus of plants belonging to the triandria claſs, and in the natural method ranking under the fourth order, *Gramina*. See BOTANY *Index.*

ELYOT, SIR THOMAS, a gentleman of eminent learning in the 16th century, was educated at Oxford, travelled into foreign countries, and upon his return was introduced to court. His learning recommended him to Henry VIII. who conferred the honour of knighthood on him, and employed him in ſeveral embaſſies: particularly in 1532, to Rome, about the divorce of Queen Catharine, and afterwards to Charles V. about 1536. He wrote, *The Caſtle of Health*, *the Governor*, *Banquet of Sapience*, *Of the Education of Children*, *De rebus memorabilibus Angliæ*, and other books; and was highly eſteemed by all his learned contemporaries.

ELYSIUM (Ελυσιος), in the ancient theology, or rather mythology, a place in the *inferi* or lower world, furniſhed with fields, meads, agreeable woods, groves, ſhades, rivers, &c. whither the ſouls of good people were ſuppoſed to go after this life.

Orpheus, Hercules, and Æneas, were ſuppoſed to have

Elyſium, Elzevirs.

have deſcended into Elyſium in their life time, and to have returned again; (Virg. lib. vi. ver. 638, &c.) Tibullus (lib. i. eleg. 3.) gives us fine deſcriptions of the Elyſian fields.

Virgil oppoſes Elyſium to Tartarus; which was the place where the wicked underwent their puniſhment.

Hic locus eſt, partes ubi ſe via findit in ambas:
Dextera, quæ Ditis magni ſub mœnia tendit:
Hac iter Elyſium *nobis: at læva malorum*
Exercet pœnas, et ad impia Tartara mittit.

He aſſigns Elyſium to thoſe who died for their country, to thoſe of pure lives, to truly inſpired poets, to the inventors of arts, and to all who have done good to mankind.

Some authors take the fable of Elyſium to have been borrowed from the Phœnicians; as imagining the name *Elyſium* formed from the Phœnician עלז *alaz*, or עלץ *alats*, or עלם *alas*, "to rejoice," or "to be in joy;" the letter *a* being only changed into *e*, as we find done in many other names; as in *Enakim* for *Anakim*, &c. On which footing, Elyſian fields ſhould ſignify the ſame thing as a place of pleaſure; or,

——— *Locos Lætos, et amœna vireta*
Fortunatorum nemorum, ſedeſque beatas. VIRG.

Others derive the word from the Greek λυω *ſolvo*, "I deliver, I let looſe or diſengage;" becauſe here men's ſouls are freed or diſencumbered from the fetters of the body. Beroaldus, and Hornius (Hiſt. Philoſoph. lib. iii. cap. 2.) take the place to have derived its name from Eliza, one of the firſt perſons who came into Greece after the deluge, and the author and father of the Ætolians.

The Elyſian fields were, according to ſome, in the Fortunate Iſlands on the coaſt of Africa, in the Atlantic. Others place them in the iſland of Leuce; and, according to the authority of Virgil, they were ſituated in Italy. According to Lucian, they were near the moon, or in the centre of the earth, if we believe Plutarch. Olaus Wormius contends that it was in Sweden the Elyſian fields were placed.

ELZEVIRS, celebrated printers at Amſterdam and Leyden, who greatly adorned the republic of letters with many beautiful editions of the beſt authors of antiquity. They fell ſomewhat below the Stephenſes in point of learning, as well as in their editions of Greek and Hebrew authors; but as to the choice of good books, they ſeem to have equalled, and in the neatneſs and elegance of their ſmall characters, greatly to have exceeded them. Their Virgil, Terence, and Greek Teſtament, have been reckoned their maſterpieces; and are indeed ſo very fine, that they juſtly gained them the reputation of being the beſt printers in Europe. There were five of theſe Elzevirs, namely, Lewis, Bonaventure, Abraham, Lewis, and Daniel. Lewis began to be famous at Leyden in 1595, and was remarkable for being the firſt who obſerved the diſtinction between the *v* conſonant and *u* vowel, which had been recommended by Ramus and other writers long before, but never regarded. Daniel died in 1680 or 1681; and though he left children who carried on the buſineſs, paſſes nevertheleſs for the laſt of his family who excelled in it. The Elzevirs have printed ſeveral catalogues of their editions; but the laſt, publiſhed by Daniel, is conſiderably enlarged, and abounds with new books. It was printed at Amſterdam, 1674, in 12mo, and divided into ſeven volumes.

Emanation, Embalming.

EMANATION, the act of flowing or proceeding from ſome ſource or origin. Such is the emanation of light from the ſun; or that of effluvia from odorous, &c. bodies; of wiſdom from God, &c.—The word is formed of the Latin *è* "out of," and *manare* "to flow or ſtream."

EMANATION is alſo uſed for the thing that proceeds, as well as the act of proceeding. The power given a judge is an emanation from the regal power; the reaſonable ſoul is an emanation from the Divinity.

EMANCIPATION, in the Roman law, the ſetting free a ſon from the ſubjection of his father; ſo that whatever moveables he acquires belong in property to him, and not to his father, as before emancipation.

Emancipation puts the ſon in a capacity of managing his own affairs, and of marrying without his father's conſent, though a minor. Emancipation differs from manumiſſion, as the latter was the act of a maſter in favour of a ſlave, whereas the former was that of a father in favour of his ſon.

There were two kinds of emancipation: the one tacit, which was by the ſon's being promoted to ſome dignity, by his coming of age, or by his marrying; in all which caſes he became his own maſter of courſe. The other, expreſs; where the father declared before a judge, that he emancipated his ſon. In performing this, the father was firſt to ſell his ſon imaginarily to another, whom they called *pater fiduciarius*, father in truſt; of whom being bought back again by the natural father, he manumitted him before the judge by a verbal declaration.

Emancipation formerly obtained in France with regard to minors or pupils, who were hereby ſet at liberty to manage their own effects, without the advice or direction of their parents or tutors.

EMARGINATED, among botaniſts. See BOTANY *Index*.

EMASCULATION, the act of caſtrating or depriving a male of thoſe parts which characterize his ſex. See CASTRATION and EUNUCH.

EMAUS, EMMAUS, or *Ammaus*, in *Ancient Geography*, a village, 60 ſtadia to the north weſt of Jeruſalem, or about ſeven miles: it afterwards became a town, and a Roman colony, *Nicopolis*, (Jerome). Reland has another *Emmaus* towards Lydda, 22 miles from Jeruſalem, (Itinerary); a third, near Tiberias.

EMBALMING, is the opening a dead body, taking out the inteſtines, and filling the place with odoriferous and deſiccative drugs and ſpices, to prevent its putrefying. The Egyptians excelled all other nations in the art of preſerving bodies from corruption; for ſome that they have embalmed upwards of 2000 years ago, remain whole to this day, and are often brought into other countries as great curioſities. Their manner of embalming was thus: they ſcooped the brains with an iron ſcoop out at the noſtrils, and threw in medicaments to fill up the vacuum: they alſo took out the entrails, and having filled the body with myrrh, caſſia, and other ſpices, except frankincenſe, proper to dry up the humours, they pickled it in nitre, where it lay

Embalming || Embargo.

lay ſoaking for 70 days. The body was then wrapped up in bandages of fine linen and gums, to make it ſtick like glue; and ſo was delivered to the kindred of the deceaſed, entire in all its features, the very hairs of the eye-lids being preſerved. They uſed to keep the bodies of their anceſtors, thus embalmed, in little houſes magnificently adorned, and took great pleaſure in beholding them, alive as it were, without any change in their ſize, features, or complexion. The Egyptians alſo embalmed birds, &c. The prices for embalming were different; the higheſt was a talent, the next 20 mine, and ſo decreaſing to a very ſmall matter: but they who had not wherewithal to anſwer this expence, contented themſelves with infuſing, by means of a ſyringe, through the fundament, a certain liquor extracted from the cedar; and, leaving it there, wrapped up the body in ſalt of nitre: the oil thus preyed upon the inteſtines, ſo that when they took it out, the inteſtines came away with it, dried, and not in the leaſt putrified: the body being encloſed in nitre, grew dry, and nothing remained beſides the ſkin glued upon the bones.

The method of embalming uſed by the modern Egyptians, according to Maillet, is to waſh the body ſeveral times with roſe-water, which, he elſewhere obſerves, is more fragrant in that country than with us; they afterwards perfume it with incenſe, aloes, and a quantity of other odours, of which they are by no means ſparing; and then they bury the body in a winding ſheet, made partly of ſilk and partly of cotton, and moiſtened, as is ſuppoſed, with ſome ſweet-ſcented water or liquid perfume, though Maillet uſes only the term *moiſtened*; this they cover with another cloth of unmixed cotton, to which they add one of the richeſt ſuits of clothes of the deceaſed. The expence, he ſays, on theſe occaſions, is very great, though nothing like what the genuine embalming coſt in former times.

EMBARCADERO, in commerce, a Spaniſh term, much uſed along the coaſts of America, particularly thoſe on the ſide of the South ſea. It ſignifies a place which ſerves ſome other conſiderable city farther within land, for a port or place of ſhipping, i. e. of embarking and diſembarking commodities. Thus Calao is the embarcadero of Lima, the capital of Peru; and Arica the embarcadero of Potoſi. There are ſome embarcaderos 40, 50, and even 60 leagues off the city which they ſerve in that capacity.

EMBARGO, in commerce, an arreſt on ſhips or merchandiſe, by public authority; or a prohibition of ſtate, commonly on foreign ſhips, in time of war, to prevent their going out of port, ſometimes to prevent their coming in, and ſometimes both, for a limited time.

The king may lay embargoes on ſhips, or employ thoſe of his ſubjects, in time of danger, for the ſervice and defence of the nation; but they muſt not be for the private advantage of a particular trader or company; and therefore a warrant to ſtay a ſingle ſhip is no legal embargo. No inference can be made from embargoes which are only in war-time; and are a prohibition by advice of council, and not at proſecution of parties. If goods be laden on board, and after an embargo or reſtraint from the prince or ſtate comes forth, and then the maſter of the ſhip breaks ground, or endeavours to ſail, if any damage accrues, he muſt be reſponſible for the ſame; the reaſon is, becauſe his freight is due, and muſt be paid, even though the goods be ſeized as contraband. Embarraſs || Emblem.

EMBARRASS, (*Embarraſſment*), a French term, though now naturalized; denoting a difficulty or obſtacle which perplexes or confounds a perſon, &c.

EMBASSADOR. See AMBASSADOR.

EMBASSY, the office or function of an AMBASSADOR.

EMBDEN, a port-town and city of Germany, capital of a county of the ſame name, now in poſſeſſion of the king of Pruſſia; it is ſituated at the mouth of the river Ens. E. Long. 6. 45. N. Lat. 53. 50.

EMBER-WEEKS, are thoſe wherein the *ember*, or *embring days* fall.

In the laws of King Alfred, and thoſe of Canute, thoſe days are called *ymbren*, that is, circular days, from whence the word was probably corrupted into *ember days*: by the canoniſts they are called *quatuor anni tempora*, the four cardinal ſeaſons, on which the circle of the year turns: and hence Henſhaw takes the word to have been formed, viz. by corruption from *temper* of *tempora*.

The ember-days are, the Wedneſday, Friday, and Saturday, after Quadrageſima Sunday, after Whitſunday, after Holy-rood day in September, and after St Lucia's day in December: which four times anſwer well enough to the four quarters of the year, Spring, Summer, Autumn, and Winter.

Mr Somner thinks they were originally faſts, inſtituted to beg God's bleſſing on the fruits of the earth. Agreeable to which, Skinner ſuppoſes the word *ember* taken from the aſhes, *embers*, then ſtrewed on the head.

Theſe ember-weeks are now chiefly taken notice of, on account of the ordination of prieſts and deacons; becauſe the canon appoints the Sundays next ſucceeding the ember-weeks, for the ſolemn times of ordination: Though the biſhops, if they pleaſe, may ordain on any Sunday or holiday.

EMBERIZA, a genus of birds belonging to the order of paſſeres. See ORNITHOLOGY *Index*.

EMBLEM, a kind of painted enigma, which, repreſenting ſome obvious hiſtory, with reflections underneath, inſtructs us in ſome moral truth or other matter of knowledge. See DEVISE, ÆNIGMA, &c.

Such is that very ſignificant image of Scævola holding his hand in the fire; with the words, *Agere et pati fortiter Romanum eſt*, "To do and ſuffer courageouſly is Roman."

The word is pure Greek, formed of the verb ἐμβάλλω, "to caſt in, to inſert." Suetonius relates, that Tiberius made the word be eraſed out of the decree of the Roman ſenate, becauſe borrowed from another language.

The emblem is ſomewhat plainer and more obvious than the ænigma.—Gale defines emblem an ingenious picture, repreſenting one thing to the eye, and another to the underſtanding.

The Greeks alſo gave the name EMBLEMS, ἐμβλήματα, to inlayed or moſaic works, and even to all kinds of ornaments of vaſes, moveables, garments, &c. And the Latins uſed *emblema* in the ſame ſenſe. Accordingly, Cicero reproaching Verres with the ſtatues and fine wrought works he had plundered from the Sicilians,

Emboliſmus || Embroidery.

calls the ornaments fixed thereto (and which on occaſion might be ſeparated from them) *emblemata*. Add, that Latin authors frequently compare the figures and ornaments of diſcourſe to theſe *emblemata*. Thus, an ancient Latin poet praiſing an orator, ſays, that all his words were ranged like the pieces in moſaic:

Quam lepide λεξεις compoſtæ, ut teſſerulæ omnes,
At te pavimenti, atque emblemate *vermiculato.*

With us emblem ordinarily ſignifies no more than a painting, baſſo-relievo, or other repreſentation, intended to hold forth ſome moral or political inſtruction.

What diſtinguiſhes an emblem from a deviſe is, that the words of an emblem have a full complete ſenſe of themſelves; nay, all the ſenſe and ſignification which they have, together with the figure. But there is a yet further difference between emblem and deviſe: for a deviſe is a ſymbol appropriated to ſome perſon, or that expreſſes ſomething which concerns him particularly; whereas an emblem is a ſymbol that regards all the world alike.

Theſe differences will be more apparent, from comparing the emblem above quoted, with the deviſe of a candle lighted, and the words *Juvando conſumor*, "I waſte myſelf in doing good." See DEVISE.

EMBOLISMUS, Εμβολισμος, in *Chronology*, ſignifies "intercalation." The word is formed of εμβαλλειν, "to inſert."

As the Greeks made uſe of the lunar year, which is only 354 days; in order to bring it to the ſolar, which is 365 years, they had every two or three years an emboliſm, i. e. they added a 13th lunar month every two or three years, which additional month they called *emboliмæus*, εμβολιμαιος, becauſe inſerted, or intercalated.

EMBOSSING, or IMBOSSING, in *Architecture* and *Sculpture*, the forming or faſhioning works in relievo, whether cut with a chiſel or otherwiſe.

Emboſſing is a kind of ſculpture, wherein the figures ſtick out from the plane whereon it is cut: and according as the figures are more or leſs prominent, they are ſaid to be in alto, mezzo, or baſſo, relievo; or high, mean, or low relief. See ENCHASING.

EMBOTHRIUM, a genus of plants belonging to the tetrandria claſs. See BOTANY *Index*.

EMBRASURE, in *Architecture*, the enlargement made of the aperture of a door or window on the inſide of the wall; its uſe being to give the greater play for the opening of the door or caſement, or to admit the more light.

EMBROCATION, in *Surgery* and *Pharmacy*, an external kind of remedy, which conſiſts in an irrigation of the part affected, with ſome proper liquor, as oils, ſpirits, &c. by means of a woollen or linen cloth, or a ſponge, dipped in the ſame.

EMBROIDERY, a work in gold, or ſilver, or ſilk thread, wrought by the needle upon cloth, ſtuffs, or muſlin, into various figures. In embroidering ſtuffs, the work is performed in a kind of loom; becauſe the more the piece is ſtretched, the eaſier it is worked. As to muſlin, they ſpread it upon a pattern ready deſigned; and ſometimes, before it is ſtretched upon the pattern, it is ſtarched, to make it more eaſy to handle. Embroidery on the loom is leſs tedious than the other, in which, while they work flowers, all the threads of the muſlin, both lengthwiſe and breadthwiſe, muſt be continually counted; but, on the other hand, this laſt is much richer in points, and ſuſceptible of greater variety. Cloths too much milled are ſcarce ſuſceptible of this ornament, and in effect we ſeldom ſee them embroidered. The thinneſt muſlins are left for this purpoſe; and they are embroidered to the greateſt perfection in Saxony; in other parts of Europe, however, they embroider very prettily, and eſpecially in France. Embroidery || Emerald.

There are ſeveral kinds of embroidery: as, 1. Embroidery on the ſtamp; where the figures are raiſed and rounded, having cotton or parchment put under them to ſupport them. 2. Low embroidery; where the gold and ſilver lie low upon the ſketch, and are ſtitched with ſilk of the ſame colour. 3. Guimped embroidery: this is performed either in gold or ſilver; they firſt make a ſketch upon the cloth, then put on cut vellum, and afterwards ſew on the gold and ſilver with ſilk thread: in this kind of embroidery they often put gold and ſilver cord, tinſel, and ſpangles. 4. Embroidery on both ſides; that which appears on both ſides of the ſtuff. 5. Plain embroidery; where the figures are flat and even, without cords, ſpangles, or other ornaments.

By ſtat. 22 Geo. II. c. 36. no foreign embroidery, or gold and ſilver brocade, ſhall be imported, upon pain of being forfeited and burnt, and penalty of 100l. for each piece. No perſon ſhall ſell, or expoſe to ſale, any foreign embroidery, gold or ſilver thread, lace, fringe, brocade, or make up the ſame into any garment, on pain of having it forfeited and burnt, and penalty of 100l. All ſuch embroidery, &c. may be ſeized and burnt; and the mercer, &c. in whoſe cuſtody it was found, ſhall forfeit 100l.

EMBRUN, or AMBRUN, a city of Dauphiny, in France, near the confines of Piedmont. E. Long. 6. 6. N. Lat. 44 35.

EMBRYO, in *Phyſiology*, the firſt rudiments of an animal in the womb, before the ſeveral members are diſtinctly formed; after which period it is denominated a *fetus*. See GENERATION and FETUS.

EMERALD, a genus of precious ſtones belonging to the order of ſiliceous earths. The word is derived, according to ſome, from the French *eſmaraude*, and that from the Latin *ſmaragdus*, ſignifying the ſame thing; by others it is ſaid to be derived from the Italian *ſmeraldo*, or the Arabian *zomorrad*. According to Cronſtedt the emerald is the ſofteſt of all the precious ſtones, though other naturaliſts place it the next after the diamond in this reſpect. It is perhaps the moſt beautiful of all the gems, and, according to Wallerius, when heated in the fire, changes its colour to a deep blue, and becomes phoſphoreſcent; but recovers its green colour when cold. When pulverized it has a white appearance, and, with borax, melts to a very thin and colourleſs glaſs. It becomes electric by being rubbed, and ſome have the property of the tourmalin, viz. of being electrified by heat, and in that ſtate attracting aſhes or other light ſubſtances; though the emeralds are leſs powerful than the tourmalin, and after having attracted the aſhes, they retain them without any ſigns of repulſion.

Pliny mentions twelve different kinds of theſe precious ſtones; though it appears, from the vaſt ſize of ſome of them, that they muſt have been only certain kinds of green ſpar, or other green ſtone, which at that time

Emerald. time went under the name of *emerald* among the ancients. The true emerald is found only in very ſmall cryſtals, from the ſize of $\frac{1}{8}$th of an inch in diameter to that of a walnut. Theophraſtus, however, mentions one four cubits long and three broad; likewiſe an obeliſk compoſed of only four emeralds, the whole length being 40 cubits, and the breadth from four to two.

Engeſtroom informs us, that the emeralds, in their rough or native ſtate, conſiſt of hexagonal columns moſtly truncated at both ends; and that he had ſome in his poſſeſſion, which in a gentle heat became colourleſs; but in a ſtrong heat white and opaque, without any mark of fuſion. Brunick diſtinguiſhes them into two claſſes. 1. The pale green emerald, which comes from the eaſt and from Peru, the figure being that of an hexagonal truncated priſm, and the baſis a vein of white quartz. 2. The dark green emerald, which is alſo columnar, but very dark coloured, ſtriped longitudinally, and has little tranſparency. The points are generally broken off longitudinally, though Davila mentions one reſembling a blunt triangular pyramid; and in the Imperial cabinet at Vienna there is one with a five-ſided pyramid. Theſe are the emeralds which become electrical by heat; though all of them do not; and thoſe which do ſo cannot be known but by actual experiment. The fineſt ſpecimen of the former kind of emeralds is to be ſeen in the treaſury of the holy chapel of Loretto, containing upwards of 100 of theſe precious ſtones great and ſmall. A fellow to this was made by art, and both were preſents to the king of Sicily, deſigned to repreſent two Mount Calvaries.

Emeralds are diſtinguiſhed by the jewellers into two kinds, the oriental and occidental. The true oriental emerald is very ſcarce, and at preſent only found in the kingdom of Cambay. So great indeed is the ſcarcity of them, that an opinion prevailed that there are no oriental emeralds. This opinion is adopted, among others, by Mr Bruce; who informs us, that he made an excurſion to the iſland of emeralds in the Red ſea, and endeavours to ſhow that there never were any emeralds but what came from America, and that thoſe ſaid to have been found in the Eaſt Indies were imported from that continent. It is probable indeed, that in former times any kind of cryſtal tinged of a green colour might be called an *emerald*, and hence the green cockle ſpar brought from Egypt may have obtained the name of *mother of emeralds*; but of late ſome emeralds have been brought from Cambay into Italy which greatly excelled thoſe of America. The beſt emeralds of the weſtern continent come from Peru, and are called *oriental* by the jewellers: ſome are found in Europe, principally in the duchy of Sileſia in Germany.

Rough EMERALDS.—Thoſe of the firſt and coarſeſt ſort, called *plaſmes*, for grinding, are worth 27 ſhillings ſterling the marc, or 8 ounces. The demi-morillons, 8l. ſterling per marc. Good morillons, which are only little pieces, but of fine colour, from 13l. to 15l. per marc. Emeralds, larger than morillons, and called *of the third colour* or *ſort*, are valued at from 50l. to 60l. the marc. Emeralds, called *of the ſecond ſort*, which are in larger and finer pieces than the preceding, are worth from 65l. to 75l. per marc. Laſtly, thoſe of the firſt colour, otherwiſe called *negres cartes*, are worth from 110l. to 115l.

EMERALDS ready cut, or poliſhed and not cut, being of good ſtone, and a fine colour, are worth— Emeralds ‖ Emerſon.

	L.	s.
Thoſe weighing one carat, or four grains	0	10
Thoſe of two carats	1	7
Thoſe of three carats	2	5
Thoſe of four carats	3	10
Thoſe of five carats	4	10
Thoſe of ſix carats	7	10
Thoſe of ſeven carats	15	0
Thoſe of eight carats	19	0
Thoſe of nine carats	23	0
Thoſe of ten carats	33	0

To counterfeit EMERALDS: Take of natural cryſtal, four ounces; of red lead, four ounces; verdegris, forty-eight grains; crocus martis, prepared with vinegar, eight grains: let the whole be finely pulverized and ſifted; put this into a crucible, leaving one inch empty: lute it well, and put it into a potter's furnace, and let it ſtand there as long as they do their pots. When cold, break the crucible; and you will find a matter of a fine emerald colour, which, after it is cut and ſet in gold, will ſurpaſs in beauty an oriental emerald.

EMERSION, in *Phyſics*, the riſing of any ſolid above the ſurface of a fluid ſpecifically heavier than itſelf, into which it had been violently immerged or thruſt.

It is one of the known laws of hydroſtatics, that a lighter ſolid being forced down into a heavier fluid, immediately endeavours to emerge; and that with a force or moment equal to the exceſs of weight of a quantity of the fluid above that of an equal bulk of the ſolid. Thus, if a ſolid be immerged in a fluid of double its ſpecific gravity, it will emerge again till half its bulk or body be above the ſurface of the fluid.

EMERSION, in *Aſtronomy*, is when the ſun, moon, or other planet, begins to re-appear, after its having been eclipſed, or hid by the interpoſition of the moon, earth, or other body.

The difference of longitude is ſometimes found by obſerving the immerſions and emerſions of the firſt of Jupiter's ſatellites. The immerſions are obſerved from the time of Jupiter's being in conjunction with the ſun to his oppoſition; and the emerſions, from the oppoſition to the conjunction; which two intervals are uſually ſix months a-piece, and divide the year between them. But when Jupiter is in conjunction with the ſun, and 15 days before and afterwards, there is nothing to be obſerved; the planet, with his ſatellites, being then loſt in the light of the ſun.

EMERSION is alſo uſed when a ſtar, before hid by the ſun, as being too near him, begins to re-appear and to get out of his rays.

EMERSON, WILLIAM, an eminent mathematician, was born in June 1701, at Hurworth, a village about three miles ſouth of Darlington; at leaſt it is certain that he reſided here from his childhood. His father Dudley Emerſon was a tolerable proficient in mathematics; and without his books and inſtructions, perhaps his own genius (moſt eminently fitted from mathematical diſquiſitions) would have never been unfolded. He was inſtructed in the learned languages by a young clergyman, then curate of Hurworth, who was

Emerſon. was boarded at his father's houſe. In the earlier part of his life he attempted to teach a few ſcholars: but whether from his conciſe method (for he was not happy in explaining his ideas), or the warmth of his natural temper, he made no progreſs in his ſchool: he therefore ſoon left it off; and ſatisfied with a moderate competence left him by his parents, he devoted himſelf to a ſtudious retirement. Towards the cloſe of the year 1781 (being ſenſible of his approaching diſſolution), he diſpoſed of the whole of his mathematical library to a bookſeller at York; and on May 20th 1782, he died of a lingering and painful diſorder at his native village, aged near 81 years.

Mr Emerſon in his perſon was rather ſhort, but ſtrong and well-made, with an open countenance and ruddy complexion. He was exceedingly ſingular in his dreſs. He had but one coat, which he always wore open before, except the lower button; no waiſtcoat; his ſhirt quite the reverſe of one in common uſe, no opening before, but buttoned cloſe at the collar behind; a kind of ſlaxen wig which had not a crooked hair in it, and probably had never been tortured with a comb from the time of its being made. He always walked up to London when he had any thing to publiſh, reviſing ſheet by ſheet himſelf:—Truſting no eyes but his own, was always a favourite maxim with him. He never advanced any mathematical propoſition that he had not firſt tried in practice, conſtantly making all the different parts himſelf on a ſmall ſcale, ſo that his houſe was filled with all kinds of mechanical inſtruments together or disjointed. He would frequently ſtand up to his middle in water while fiſhing, a diverſion he was remarkably fond of. He uſed to ſtudy inceſſantly for ſome time, and then for relaxation take a ramble to any pot-alehouſe where he could get any body to drink with and talk to. The duke of Manchеſter was highly pleaſed with his company, and uſed often to come to him in the fields and accompany him home, but could never perſuade him to get into a carriage. On theſe occaſions he would ſometimes exclaim, "Damn your whim-wham! I had rather walk." He was a married man; and his wife uſed to ſpin on an old-faſhioned wheel, whereof a very accurate drawing is given in his mechanics. He was deeply ſkilled in the ſcience of muſic, the theory of ſounds, and the various ſcales both ancient and modern, but was a very poor performer.

The following is a liſt of Mr Emerſon's works. 1. The Doctrine of Fluxions. 2. The Projection of the Sphere, orthographic, ſtereographic, and gnomonical. 3. The Elements of Trigonometry. 4. The Principles of Mechanics. 5. A Treatiſe of Navigation on the Sea. 6. A Treatiſe of Algebra, in two books. 7. The Arithmetic of Infinites, and the differential Method, illuſtrated by Examples. 8. Mechanics; or the Doctrine of Motion. 9. The Elements of Optics, in four books. 10. A Syſtem of Aſtronomy. 11. The Laws of Centripetal and Centrifugal Force. 12. The Mathematical Principles of Geography. 13. Tracts, 8vo. 14. Cyclomatheſis; or an eaſy Introduction to the ſeveral branches of the Mathematics. 15. A ſhort comment on Sir Iſaac Newton's Principia; to which is added, A Defence of Sir Iſaac againſt the objections that have been made to ſeveral Parts of his Works. 16. A Miſcellaneous Treatiſe, containing ſeveral Mathematical Subjects, 8vo. 1776. Emery.

EMERY, in *Natural Hiſtory*, a rich iron-ore found in large maſſes of no determinate ſhape or ſize, extremely hard, and very heavy. It is uſually of a duſky brownish red on the ſurface; but when broken, is of a fine bright iron-gray, but not without ſome tinge of redneſs; and is ſpangled all over with ſhining ſpecks, which are ſmall flakes of a foliaceous ſtalk, highly impregnated with iron. It is alſo ſometimes very red, and then uſually contains veins of gold. It makes no effervescence with any of the acid menſtruums; and is found in the iſland of Guernſey, in Tuſcany, and many parts of Germany.

Dr Lewis is of opinion, that ſome kinds of emery may contain the metal called *platina*, and on this ſubject has the following curious obſervations. "Alonſo Barba mentions a ſubſtance called *chumpi*; which is a hard ſtone of the emery kind, participating of iron, of a gray colour ſhining a little, very hard to work, becauſe it reſiſts the fire much, found in Potoſi, Chocaya, and other places, along with blackiſh and reddiſh ores that yield gold. If platina is really found in large maſſes, either generally or only now and then, one might reaſonably expect thoſe maſſes to be ſuch as are here deſcribed.

"Of the ſame kind perhaps alſo is the mineral mentioned by ſeveral authors under the name of Spaniſh emery, *ſmiris Hiſpanicus*, which ſhould ſeem, from the accounts given of it, to be no other than platina or its matrix. The *ſmiris* is ſaid to be found in the gold mines, and its exportation prohibited; to contain ſilms or veins of native gold; to be in great requeſt among the alchemiſts; to have been ſometimes uſed for the adulteration of gold; to ſtand, equally with the noble metal, cupellation, quartation, antimony, and the regal cement; and to be ſeparable from it by amalgamation with mercury, which throws out the *ſmiris* and retains the gold; properties ſtrongly characteriſtic of platina, and which do not belong to any known ſubſtance beſides. This debaſement of gold *per extractum ſmiridis Hiſpanici* is mentioned by Becher in his *Minera arenaria*, and ſeveral times hinted at in his *Phyſica ſubterranea*. Both Becher and Stahl indeed call the ſubſtance which the gold receives from the emery an earth, whereas platina is undoubtedly a metal; but this does not at all invalidate our ſuppoſition, for they give the name of earth alſo to the ſubſtance which copper receives from calamine in being made into braſs, which is now known to be metallic.

"From theſe obſervations I have been led to ſuſpect, that the European emeries likewiſe might poſſibly participate of platina. If this was certain, it would account ſatisfactorily for the uſe which ſome of the alchemiſts are ſaid to have made of emeries and other ferruginous ores; and we ſhould no longer doubt, or wonder, that by treating gold with theſe kinds of minerals, they obtained a permanent augmentation; that this augmentation, though it reſiſted lead, antimony, aquafortis, and the regal cement, was ſeparable, as Becher owns it was, by quickſilver; and that, when it exceeded certain limits, it rendered the gold pale and brittle.

"If emery contains platina, I imagined it might be

Emery || Emir.

be diſcoverable by boiling the powdered mineral in melted lead, and afterwards working off the lead upon a teſt or cupel. The experiment was made with eight ounces of the fineſt powder of common emery, and the ſame quantity of lead; which were covered with black flux to prevent the ſcorification of the lead, and urged with a ſtrong fire for two or three hours. The lead became hard, rigid, of a dark colour, and a granulated texture, as if it had really imbibed ſome platina from the emery; but in cupellation it worked almoſt entirely off, leaving only a head about the ſize of a ſmall pin's head, which was probably no other than ſilver contained in the lead.

"I repeated the experiment with ſome variation, thinking to obtain a more perfect reſolution of the emery by vitrifying it with the lead. Two ounces of fine emery and ſix ounces of minium were well mixed together, and urged with a ſtrong fire, in a cloſe crucible, for an hour: they melted into an uniform dark brownish glaſs. The glaſs was powdered, mixed with four ounces of fixt alkaline ſalt and ſome powdered charcoal, and put into a freſh crucible, with ſome common ſalt on the ſurface: The fire was pretty ſtrongly excited; but the fuſion was not ſo perfect as could be wiſhed, and only about two ounces of lead were found revived. This lead had ſuffered nearly the ſame change as that in the foregoing experiment; and like it, gave no appearance of platina on being cupelled.

"It ſeems to follow from theſe experiments, that the emery employed in them contained no platina; but as it is not to be ſuppoſed that all emeries are of one compoſition, other ſorts may deſerve to be ſubmitted to the ſame trials. As gold is contained in ſome parcels of common minerals, and by no means in all the individuals of any one ſpecies; platina may poſſibly in like manner be found in ſome European ores, though there is not the leaſt footſtep of it in other parcels of the ſame kind of ore."

EMETICS, medicines that induce vomiting. See Materia Medica *Index*.

EMIMS, ancient inhabitants of the land of Canaan beyond Jordan, who were defeated by Chedorlaomer and his allies, Gen. xiv. 5. Moſes tells us, that they were beaten in Shaveh Kirjathaim, which was in the country of Sihon conquered from the Moabites, Joſh. xiii. 19.—21. The Emims were a warlike people, of a gigantic ſtature, great and many, and tall as the Anakims.

EMINENCE, in *Geography*, a little hillock or aſcent above the level of the adjoining champaign.

Eminence is alſo a title of honour given to cardinals. The decree of the Pope, whereby it was appointed that the cardinals ſhould be addreſſed under the quality of *eminence*, bears date the 10th of January 1630. They then laid aſide the titles of *illuſtriſſimi* and *reverendiſſimi*, which they had borne before.

The grand maſter of Malta is likewiſe addreſſed under the quality of *eminence*. The popes John VIII. and Gregory VII. gave the ſame title to the kings of France. The emperors have likewiſe borne it.

Eminentiſſimus, the ſuperlative of *eminent*, has of late been attributed to the cardinals.

EMIR, a title of dignity among the Turks, ſignifying a prince.

This title was firſt given to the caliphs; but when they aſſumed the title of Sultans, that of emir remained to their children; as that of Ceſar among the Romans. At length the title came to be attributed to all who were judged to deſcend from Mahomet by his daughter Fatimah, and who wear the green turban inſtead of the white. The Turks make an obſervation, that the emirs, before their fortieth year, are men of the greateſt gravity, learning, and wiſdom; but after this, if they are not great fools, they diſcover ſome ſigns of levity and ſtupidity. This is interpreted by the Turks as a ſort of divine impulſe in token of their birth and ſanctity. The Turks alſo call the vizirs, bashaws, or governors of provinces, by this name.

Emiſſary || Emmius.

EMISSARY, in a political ſenſe, a perſon employed by another to ſound the opinions of people, ſpread certain reports, or act as a ſpy over other people's actions.

Emissary Veſſels, in *Anatomy*, the ſame with thoſe more commonly called Excretory.

EMISSION, in *Medicine*, a term uſed chiefly to denote the ejaculation of the ſemen or ſeed in the act of coition. See Coition and Generation.

EMMANUEL, or Immanuel, a Hebrew word which ſignifies 'God with us.' Iſaiah (viii. 14.), in that celebrated propheſy, wherein he declares to Ahaz the birth of the Meſſiah, who was to be born of a virgin, ſays, This child ſhall be called, and really be, Emmanuel, that is, *God with us*. The ſame prophet (viii. 8.) repeats the ſame thing, while he is ſpeaking of the enemy's army, which, like a torrent, was to overflow Judea. 'The ſtretching out of his wings ſhall fill the breadth of thy land, O Emmanuel.' The evangeliſt Matthew (i. 23.) informs us, that this propheſy was accompliſhed in the birth of Chriſt, born of the virgin Mary, in whom the two natures divine and human were united, and ſo in this ſenſe he was really Emmanuel, or 'God with us.'

EMMERICK, a rich fortified town of Germany, in the circle of Weſtphalia, and duchy of Cleves. It carries on a good trade with the Dutch, and both Proteſtants and Catholics have the free exerciſe of their religion. The ſtreets are neat and regular, and the houſes tolerably built. It was taken by the French in 1672, and delivered to the elector of Brandenburg in 1673, under whoſe juriſdiction it now is. It is ſeated near the Rhine. E. Long. 5. 29. N. Lat. 52. 5.

EMMIUS, Ubbo, born at Gretha in Eaſt Frieſland in 1547, was a very learned profeſſor, and choſen rector of the college of Norden in 1579. This ſeminary flouriſhed exceedingly under his care; and declined as viſibly after he was ejected, in 1587, for refuſing to ſubſcribe the Confeſſion of Augſburg. The year after, he was made rector of the college of Leer; and when the city of Groningen confederated with the United Provinces, the magiſtrates appointed him rector of that college: which employment he filled with the higheſt repute near 20 years; until, the college being erected into an univerſity, he was the firſt rector, and one of the chief ornaments of it by his lectures, till his infirmities prevented his public appearance. His wiſdom was equal to his learning; ſo that the governor of Frieſland and Groningen often conſulted him, and ſeldom failed to follow his advice. He wrote

Vetus

Emmenagogues || Emouy.

Vetus Græcia illuſtrata, 3 vols; *Decades Rerum Freſicarum*; and many other valuable works. He died in 1625.

EMMENAGOGUES, Εμμηναγωγα, in *Medicine*, ſuch remedies as promote the menſtrual diſcharge. They are thus called from εν "in," μην "month," αγω *duco*, "I lead," becauſe their natural periods of flowing are once a-month.

EMOLLIENTS, in *Medicine* and *Pharmacy*, are ſuch remedies as ſheath and ſoften the aſperity of the humours, and relax and ſupple the ſolids at the ſame time.

EMOLUMENT, is properly applied to the profits ariſing daily from an office or employ. The word is formed of the Latin *emolumentum*, which, according to ſome, primarily ſignifies the profits redounding to the miller from his mill; of *molo*, *molere*, "to grind."—The patent, or other inſtrument, whereby a perſon is preferred to an office, gives him a right to enjoy all the duties, honours, profits, and emoluments belonging thereto.—*Emolument* is alſo uſed, in a ſomewhat greater latitude, for profit or advantage in the general.

EMOTION and PASSION, in the human mind, are thus diſtinguiſhed by a celebrated writer *. An internal motion or agitation of the mind, when it paſſeth away without deſire, is denominated *an emotion:* when deſire follows, the motion or agitation is denominated *a paſſion*. A fine face, for example, raiſeth in me a pleaſant feeling: if that feeling vaniſh without producing any effect, it is in proper language an *emotion;* but if the feeling, by reiterated views of the object, becomes ſufficiently ſtrong to occaſion deſire, it loſes its name of emotion, and acquires that of *paſſion*. The ſame holds in all the other paſſions. The painful feeling raiſed in a ſpectator by a ſlight injury done to a ſtranger, being accompanied with no deſire of revenge, is termed an emotion; but that injury raiſeth in the ſtranger a ſtronger emotion, which being accompanied with deſire of revenge, is a paſſion. External expreſſions of diſtreſs produce in the ſpectator a painful feeling, which being ſometimes ſo ſlight as to paſs away without any effect, is an emotion; but if the feeling be ſo ſtrong as to prompt deſire of affording relief, it is a paſſion, and is termed *pity*. Envy is emulation in exceſs: if the exaltation of a competitor be barely diſagreeable, the painful feeling is an emotion; if it produce deſire to depreſs him, it is a paſſion. See PASSION.

* *Elem. of Criticiſm*, vol. i. p. 45.

EMOUY, or HIA-MEN, an iſland and port of China, under the juriſdiction of the province of FO-KIEN.

The port is properly but an anchoring-place for ſhips, incloſed on one ſide by the iſland from which it takes its name, and on the other by the main land: but it is ſo extenſive, that it can contain ſeveral thouſands of veſſels; and the depth of its water is ſo great, that the largeſt ſhips may lie cloſe to the ſhore without danger.

In the beginning of the preſent century it was much frequented by European veſſels; but few viſit it at preſent, as all the trade is carried on at Canton. The emperor keeps here a garriſon of 6 or 7000 men, commanded by a Chineſe general. In entering this road, a large rock muſt be doubled which ſtands at the mouth of it, and divides it almoſt as the Mingant divides the harbour of Breſt. This rock is viſible, and riſes ſeveral feet above the ſurface of the water. Emouy.

The iſland of Emouy is particularly celebrated on account of the magnificence of its principal pagod, conſecrated to the deity Fo. This temple is ſituated in a plain, terminated on one ſide by the ſea, and on the other by a lofty mountain. Before it the ſea, flowing through different channels, forms a large ſheet of water which is bordered with turf of the moſt beautiful verdure. The front of this edifice is 180 feet to length, and its gate is adorned with figures in relief, which are the uſual ornaments of the Chineſe architecture. On entering, you find a vaſt portico, with an altar in the middle, on which is placed a gigantic ſtatue of gilt braſs, repreſenting the god Fo, ſitting croſs-legged. Four other ſtatues are placed at the corners of this portico, which are 18 feet high, although they repreſent people ſitting. Each of theſe ſtatues is formed from a ſingle block of ſtone. They bear in their hands different ſymbols which mark their attributes, as formerly in Athens and Rome the trident and caduceus diſtinguiſhed Neptune and Mercury. One holds a ſerpent in his arms, which is twiſted round its body in ſeveral folds; the ſecond has a bent bow and a quiver; the two others preſent, one a kind of battle-axe, and the other a guitar, or ſome inſtrument of the ſame kind.

After croſſing this portico, you enter a ſquare outer court, paved with large gray ſtones, the leaſt of which is ten feet in length and four in breadth. At the four ſides of this court ariſe four pavilions, which terminate in domes, and have a communication with one another by means of a gallery which runs quite round it. One of theſe contains a bell ten feet in diameter; the wooden-work which ſupports this heavy maſs cannot be ſufficiently admired. In the other is kept a drum of an enormous ſize, which the bonzes uſe to proclaim the days of new and full moon. It muſt be obſerved, that the clappers of the Chineſe bells are on the outſide, and made of wood in the form of a mallet. The two other pavilions contain the ornaments of the temple, and often ſerve to lodge travellers, whom the bonzes are obliged to receive. In the middle of this court is a large tower, which ſtands by itſelf, and terminates alſo in a dome, to which you aſcend by a beautiful ſtone ſtair-caſe that winds round it. This dome contains a temple remarkably neat; the ceiling is ornamented with moſaic work, and the walls are covered with ſtone figures in relief, repreſenting animals and monſters. The pillars which ſupport the roof of this edifice are of wood varniſhed; and on feſtivals are ornamented with ſmall flags of different colours. The pavement of the temple is formed of little ſhells, and its different compartments preſent birds, butterflies, flowers, &c.

The bonzes continually burn incenſe upon the altar, and keep the lamps lighted, which hang from the ceiling of the temple. At one extremity of the altar ſtands a brazen urn, which when ſtruck ſends forth a mournful ſound: on the oppoſite ſide is a hollow machine of wood, of an oval form, uſed for the ſame purpoſe, which is to accompany with its ſound their voices when they ſing in praiſe of the tutelary idol of the pagod. The god Pouſſa is placed on the middle of this altar, on a flower of gilt braſs, which ſerves as a baſe, and holds

Emouy, Empalement.

holds a young child in his arms; ſeveral idols, which are no doubt ſubaltern deities, are ranged around him, and ſhow by their attitudes their reſpect and veneration.

The bonzes have traced out on the walls of this temple ſeveral hieroglyphical characters in praiſe of Pouſſa; there is alſo to be ſeen an hiſtorical or allegorical painting in freſco, which repreſents a burning lake, in which ſeveral men appear to be ſwimming, ſome carried by monſters, others ſurrounded by dragons and winged ſerpents. In the middle of the gulf riſes a ſteep rock, on the top of which the god is ſeated, holding in his arms a child, who ſeems to call out to thoſe who are in the flames of the lake; but an old man, with hanging ears and horns on his head, prevents them from climbing to the ſummit of the rock, and threatens to drive them back with a large club. The bonzes are at a loſs what anſwer to give, when any queſtions are aſked them concerning this painting. Behind the altar is a kind of library, containing books which treat of the worſhip of idols.

On deſcending from this dome you croſs the court, and enter a kind of gallery, the walls of which are lined with boards; it contains 24 ſtatues of gilt braſs, repreſenting the ſame number of philoſophers, ancient diſciples of Confucius. At the end of this gallery you find a large hall, which is the refectory of the bonzes; and after having traverſed a ſpacious apartment, you at length enter the temple of Fo, to which there is an aſcent by a large ſtone ſtaircaſe. It is ornamented with vaſes full of artificial flowers (a work in which the Chineſe excel); and here alſo are found the ſame kind of muſical inſtruments as thoſe mentioned before. The ſtatue of the god is not to be ſeen but through a piece of black gauze, which forms a kind of veil or curtain before the altar. The reſt of the pagod conſiſts of ſeveral large chambers, exceedingly neat, but badly diſpoſed; the gardens and pleaſure grounds are on the declivity of the mountain; and a number of delightful grottoes are cut out in the rock, which afford an agreeable ſhelter from the exceſſive heat of the ſun.

There are ſeveral other pagods in the iſle of Emouy; among which is one called *The Pagod of the Ten Thouſand Stones*, becauſe it is built on the brow of a mountain where there is a like number of little rocks, under which the bonzes have formed grottoes and very pleaſant covered ſeats. A certain rural ſimplicity reigns here, which captivates and delights.

Strangers are received by theſe bonzes with great politeneſs, and may freely enter their temples; but they muſt not attempt to gratify their curioſity fully, nor to enter thoſe apartments into which they are not introduced, eſpecially if they are accompanied by ſuſpicious perſons; for the bonzes, who are forbid under pain of ſevere puniſhment to have any intercourſe with women, and who often keep them in private, might, from fear of being diſcovered, revenge themſelves for too impertinent a curioſity.

EMPALEMENT, an ancient kind of puniſhment, which conſiſted in thruſting a ſtake up the fundament. The word comes from the French *empaler*, or the Italian *impalare;* or rather, they are all alike derived from the Latin *palus*, "a ſtake," and the prepoſition *in*, "in or into." We find mention of empaling in Juvenal. It was frequently practiſed in the time of Nero, and continues to be ſo in Turkey. Empalement || Emperor.

Empalement of a flower, the ſame with Calyx.

EMPANELLING. See Impanelling.

EMPARLANCE. See Imparlance.

EMPEDOCLES, a celebrated philoſopher and poet, was born at Agrigentum, a city in Sicily. He followed the Pythagorean philoſophy, and admitted the metempſychoſis. He conſtantly appeared with a crown of gold on his head; to maintain, by this outward pomp, the reputation he had acquired of being a very extraordinary man. Yet Ariſtotle ſays, that he was a great lover of liberty, extremely averſe to ſtate and command, and that he even refuſed a kingdom that was offered him. His principal work was a Treatiſe in verſe on the Nature and Principles of Things. Ariſtotle, Lucretius, and all the ancients, make the moſt magnificent elogiums on his poetry and eloquence.

He taught rhetoric; and often alleviated the anxieties of his mind, as well as the pains of his body, with muſic. It is reported, that his curioſity to viſit the flames of the crater of Ætna proved fatal to him. Some maintain that he wiſhed it to be believed that he was a god; and that his death might be unknown, he threw himſelf into the crater and periſhed in the flames. His expectations, however, were fruſtrated; and the volcano, by throwing up one of his ſandals, diſcovered to the world that Empedocles had periſhed by fire. Others report that he lived to an extreme old age; and that he was drowned in the ſea about 440 years before the Chriſtian era.

EMPEROR, (*Imperator*), among the ancient Romans, ſignified a general of an army, who, for ſome extraordinary ſucceſs, had been complimented with this appellation. Thus Auguſtus, having obtained no leſs than twenty famous victories, was as often ſaluted with the title *emperor;* and Titus was denominated *emperor* by his army after the reduction of Jeruſalem.

Afterwards it came to denominate an abſolute monarch or ſupreme commander of an empire. In this ſenſe Julius Cæſar was called *emperor:* the ſame title deſcended with the dignity to Octavius Auguſtus, Tiberius, and Caligula; and afterwards it became elective.

In ſtrictneſs, the title *emperor* does not, and cannot, add any thing to the rights of ſovereignty: its effect is only to give precedence and pre-eminence above other ſovereigns; and as ſuch, it raiſes thoſe inveſted with it to the ſummit of all human greatneſs.

It is diſputed, whether or not emperors have the power of diſpoſing of the regal title. It is true, they have ſometimes taken upon them to erect kingdoms; and thus it is that Bohemia and Poland are ſaid to have been raiſed to the dignity: thus alſo, the emperor Charles the Bald, in the year 877, gave Provence to Boſon, putting the diadem on his head, and decreeing him to be called "king," *ut more priſcorum imperatorum regibus videretur dominari.* Add, that the emperor Leopold erected the ducal Pruſſia into a kingdom in favour of the elector of Brandenburg; and though ſeveral of the kings of Europe refuſed for ſome time to acknowledge him in that capacity, yet by the treaty of Utrecht in 1712 they all came in.

In the eaſt, the title and quality of emperor are more frequent than they are among us; thus, the ſo-

Emperor. vereign princes of China, Japan, Mogul, Perſia, &c. are all emperors of China, Japan, &c. In the year 1723, the czar of Muſcovy aſſumed the title of *emperor of all Ruſſia*, and procured himſelf to be recognized as ſuch by moſt of the princes and ſtates of Europe.

In the Weſt, the title has been a long time reſtrained to the emperors of Germany. The firſt who bore it was Charlemagne, who had the title of emperor conferred on him by Pope Leo III though he had all the power before. The imperial prerogatives were formerly much more extenſive than they are at preſent. At the cloſe of the Saxon race, A. D. 1024, they exerciſed the right of conferring all the eccleſiaſtical benefices in Germany; of receiving the revenues of them during a vacancy; of ſucceeding to the effects of inteſtate eccleſiaſtics; of confirming or annulling the elections of the popes; of aſſembling councils, and of appointing them to decide concerning the affairs of the church; of conferring the title of king on their vaſſals; of granting vacant fiefs; of receiving the revenues of the empire; of governing Italy as its proper ſovereigns; of erecting free cities, and eſtabliſhing fairs in them; of aſſembling the diets of the empire, and fixing the time of their duration; of coining money, and conferring the ſame privilege on the ſtates of the empire; and of adminiſtering both high and low juſtice within the territories of the different ſtates: but in the year 1437, they were reduced to the right of conferring all dignities and titles, except the privilege of being a ſtate of the empire; of *preces primariæ*, or of appointing once during their reign a dignitary in each chapter or religious houſe; of granting diſpenſations with reſpect to the age of majority; of erecting cities, and conferring the privilege of coining money; of calling the meetings of the diet, and preſiding in them.

To which ſome have added, 1. That all the princes and ſtates of Germany are obliged to do them homage, and ſwear fidelity to them. 2. That they, or their generals, have a right to command the forces of all the princes of the empire, when united together. 3. That they receive a kind of tribute from all the princes and ſtates of the empire, for carrying on a war which concerns the whole empire, which is called the *Roman month*. For the reſt, there is not a foot of land or territory annexed to his title: but ever ſince the reign of Charles IV. the emperors have depended entirely on their hereditary dominions as the only ſource of their power, and even of their ſubſiſtence. See DIET and ELECTORS.

The kings of France were anciently alſo called emperors, at the time when they reigned with their ſons, whom they aſſociated to the crown. Thus Hugh Capet, having aſſociated his ſon Robert, took the title of emperor, and Robert that of king; under which titles they are mentioned in the Hiſtory of the Council of Rheims, by Gerbert, &c. King Robert is alſo called emperor of the French by Helgau of Fleury. Louis le Gros, upon aſſociating his ſon, did the ſame. In the Firſt Regiſter of the King's Charters, fol. 166, are found letters of Louis le Gros, dated in 1116, in favour of Raymond biſhop of Maguelonne, wherein he ſtyles himſelf, *Ludovicus, Dei ordinante providentia, Francorum imperator auguſtus*. The kings of England had likewiſe anciently the title of emperors, as appears from a charter of King Edgar: *Ego Edgarus Anglorum baſileus, omniumque regum inſularum oceani quæ Britanniam circumjacent, &c. imperator et dominus.* Empetrum || Empire.

EMPETRUM, BERRY-BEARING HEATH, a genus of plants belonging to the monœcia claſs. In the natural method this genus is ranked by Linnæus under the 54th order, *Miſcellaneæ*. See BOTANY *Index*.

EMPHASIS, in *Rhetoric*, a particular ſtreſs of the voice and action, laid on ſuch parts or words of the oration as the orator wants to inforce upon his audience. See DECLAMATION; ORATORY, Part IV.; and READING.

EMPHYSEMA, in *Surgery*, a windy tumor, generally occaſioned by a fracture of the ribs, and formed by the air inſinuating itſelf, by a ſmall wound, between the ſkin and muſcles, into the ſubſtance of the cellular or adipoſe membrane, ſpreading itſelf afterwards up to the neck, head, belly, and other parts, much after the manner in which butchers blow up their veal.

EMPIRE (*imperium*), in political geography, a large extent of land, under the juriſdiction or government of an emperor. See EMPEROR.

In ancient hiſtory we read of four great monarchies or empires, viz. that of the Babylonians, Chaldeans, and Aſſyrians; that of the Medes and Perſians; that of the Greeks; and that of the Romans. The firſt ſubſiſted from the time of Nimrod, who founded it in the year of the world 1800, according to the computation of Uſher, to Sardanapalus their laſt king in 3257, and conſequently laſted above 1450 years. The empire of the Medes commenced under Arbaces, in the year of the world 3257, and was united to that of the Babylonians and Perſians under Cyrus, in 3468, and it cloſed with the death of Darius Codomannus in 3674. The Grecian empire laſted only during the reign of Alexander the Great, beginning in the year of the world 3674, and terminating with the death of this conqueror in 3681, his conqueſts being divided among his captains. The Roman empire commenced with Julius Cæſar, when he was made perpetual dictator, in the year of the city 708, and of the world 3956, 48 years before Chriſt. The ſeat of the empire was removed to Byzantium by Conſtantine, in the year of our Lord 334; the eaſt and weſt were then united under the title of the Roman empire, till the Romans proclaimed Charlemagne emperor, A. D. 800. From this epocha the eaſt and weſt formed two ſeparate empires; that of the eaſt, governed by Greek emperors, commenced A. D. 302: and being gradually weakened, terminated under Conſtantine Palæologus in 1453. The weſtern empire was afterwards known by the appellation of the empire, or German empire.

Antiquaries diſtinguiſh between the medals of the *upper*, and *lower* or *bas*, *empire*.—The curious only value thoſe of the upper empire, which commences with Cæſar or Auguſtus, and ends in the year of Chriſt 260. The lower empire comprehends near 1200 years, reckoning down to the deſtruction of Conſtantinople in 1453.—They uſually diſtinguiſh two ages, or periods, of the lower empire: the firſt beginning where the upper ends, viz. with Aurelian, and ending with Anaſtaſius, including 200 years; the ſecond beginning with Anaſtaſius, and ending with the Palæologi, which includes 1000 years.

EMPIRE,

Empire ‖ Emporium.

EMPIRE, or *The empire*, uſed abſolutely and without any addition, ſignifies the empire of Germany: called alſo, in juridical acts and laws, The holy Roman empire. It had its beginning with the ninth century; Charlemagne being created firſt emperor by Pope Leo III. who put the crown on his head in St Peter's church on Chriſtmas-day in the year 800.

Authors are at a loſs under what form of government to range the empire. Some of them maintain it to be a monarchical ſtate, becauſe all the members thereof are obliged to aſk the inveſtiture of their ſtates of the emperor, and to take an oath of fidelity to him. Others conſider it as a republic, or ariſtocratic ſtate, becauſe the emperor cannot reſolve or determine any thing without the concurring ſuffrages of the princes. It is added, that if they require inveſtiture from, and ſwear fealty to him, it is only as head of the republic, and in the name of the republic, and not in his own; juſt as at Venice every thing is tranſacted in name of the doge. Others will have the empire to be a monarcho-ariſtocratic ſtate, *i. e.* a mixture of monarchy and ariſtocracy; becauſe, though the emperor in many caſes ſeems to act ſovereignly, yet his decrees and reſolves have no force, in caſe the ſtate refuſe to confirm them. Laſtly, it has been called an ariſto-democratic ſtate, becauſe the diet, wherein the ſovereignty is lodged, is compoſed of princes and the deputies of the cities; and is divided into three orders or bodies, called *colleges*, viz. the college of electors, the college of princes, and the college of cities.

We ſay, diet of the empire, circles of the empire, fiefs of the empire, princes of the empire, eſtates of the empire, members of the empire, capitulations of the empire. See DIET, CIRCLE, PRINCE, CAPITULATION, &c.

The ſtates or eſtates of the empire are of two kinds, mediate and immediate. The immediate ſtates are thoſe who hold immediately of the empire: Whereof, again, there are two kinds; the firſt, ſuch as have ſeats and voices in the imperial diet; the ſecond, ſuch as have none. The mediate ſtates are thoſe who hold of the immediate.

The ſtates which now compoſe the empire are, The princes of the empire, the counts of the empire, the free barons of the empire, the prelates of the empire, the princeſſes or abbeſſes of the empire, the nobles of the empire, and the imperial cities.

EMPIRIC, an appellation given to thoſe phyſicians who conduct themſelves wholly by their own experience, without ſtudying phyſic in a regular way. Some even uſe the term, in a ſtill worſe ſenſe, for a quack who preſcribes at random, without being at all acquainted with the principles of the art.

EMPIS, a genus of inſects belonging to the order Diptera. See ENTOMOLOGY *Index*.

EMPLASTER. See PLASTER.

EMPORIÆ, a double city of the Hither Spain, near the Pyrenees; ſeparated by a wall; one part occupied by the Greeks of Phocæa, whence originally are the Maſſilienſes; the other, by native Spaniards, to whom was added by Auguſtus a Roman colony. Now Ampurias, in Catalonia. E. Long. 2. 50. N. Lat. 42. 15.

EMPORIUM, in *Medicine*, is often uſed for the common ſenſory in the brain. See BRAIN.

Emporium ‖ Enamel.

EMPORIUM, in *Ancient Geography*, two cities near Placentia; one well fortified, and guarded by a ſtrong garriſon, at which Hannibal met a repulſe: the other, Hannibal took and plundered. Now thought to be Pont-Nura, in the duchy of Placentia.

EMPRESS, the ſpouſe of an emperor, or a woman who governs an empire. See EMPEROR.

EMPROSTHOTONOS, a ſpecies of convulſion, wherein the head bends forward.

EMPYÆMA, in *Medicine*, a diſorder wherein purulent matter is contained in the thorax or breaſt, after an inflammation and ſuppuration of the lungs and pleura. See MEDICINE *Index*.

EMPYREAL AIR. So Dr Higgins denominates that which Dr Prieſtley calls *dephlogiſticated* air, and other philoſophers *vital* or *pure* air.

EMPYREUM, a term uſed by divines for the higheſt heaven, where the bleſſed enjoy the beatific viſion. The word is formed of ἐν and πῦρ *fire*, becauſe of its ſplendour.

EMPYREUMA, in *Chemiſtry*, ſignifies a very diſagreeable ſmell produced from burnt oils. It is often perceived in diſtillations of animal as well as vegetable ſubſtances, when they are expoſed to a quick fire.

EMRODS. See HEMORRHOIDS.

EMULATION, a generous ardour kindled by the praiſe-worthy examples of others, which impels us to imitate, to rival, and, if poſſible, to excel them. This paſſion involves in it eſteem of the perſon whoſe attainments or conduct we emulate, of the qualities and actions in which we emulate him, and a deſire of reſemblance, together with a joy ſpringing from the hope of ſucceſs. The word comes originally from the Greek ἀμιλλα, *diſpute, conteſt*; whence the Latin, *æmulus*, and thence our *emulation*.

Plato obſerves of emulation, that it is the daughter of envy; if ſo, there is a great difference between the mother and the offſpring; the one is a virtue and the other a vice. Emulation admires great actions, and ſtrives to imitate them; envy refuſes them the praiſes that are their due; emulation is generous, and only thinks of ſurpaſſing a rival; envy is low, and only ſeeks to leſſen him. Perhaps, therefore, it would be more juſt to ſuppoſe emulation the daughter of admiration: admiration, however, is a principal ingredient in the compoſition of it.

EMULGENT, or RENAL, ARTERIES, thoſe which ſupply the kidneys with blood; being ſometimes ſingle, ſometimes double, on each ſide. See ANATOMY *Index*.

EMULSION, a ſoft liquid remedy, of a colour and conſiſtence reſembling milk. See PHARMACY.

EMUNCTORY, in *Anatomy*, a general term for all thoſe parts which ſerve to carry off the excrementitious parts of the blood and other humours of the body. Such more eſpecially are the kidneys, bladder, and moſt of the glands.

ENALLAGE, in *Grammar*, is when one word is ſubſtituted for another of the ſame part of ſpeech: A ſubſtantive for an adjective; as *exercitus victor*, for *victoriosus; ſcelus*, for, *ſceleſtus*: A primitive for a derivative; as *Dardana arma*, for *Dardania*: An active for a paſſive; as *nox humida cælo præcipitat*, for *præcipitatur*, &c.

ENAMEL, in general, is a vitrified matter betwixt

Enamel, Enamelling.

the parts of which is diſperſed ſome unvitrified matter: hence enamel ought to have all the properties of glaſs except tranſparency.

Enamels have for their baſis a pure cryſtal glaſs or frit, ground up with a fine calx of lead and tin prepared for the purpoſe, with the addition uſually of white ſalt of tartar. Theſe ingredients baked together are the matter of all enamels, which are made by adding colours of this or that kind in powder to this matter, and melting or incorporating them together in a furnace.

For white enamel, Neri (*De Arte Vitriar.*) directs only manganeſe to be added to the matter which conſtitutes the baſis. For azure, zaffer mixed with calx of braſs. For green, calx of braſs with ſcales of iron, or with crocus martis. For black, zaffer with manganeſe or with crocus martis; or manganeſe with tartar. For red, manganeſe, or calx of copper and red tartar. For purple, manganeſe with calx of braſs. For yellow, tartar and manganeſe. And for violet-coloured enamel, manganeſe with thrice-calcined braſs.

In making theſe enamels, the following general cautions are neceſſary to be obſerved. 1. That the pots muſt be glazed with white glaſs, and muſt be ſuch as will bear the fire. 2. That the matter of enamels muſt be very nicely mixed with the colours. 3. When the enamel is good, and the colour well incorporated, it muſt be taken from the fire with a pair of tongs. 4. The general way of making the coloured enamel is this: Powder, ſift, and grind, all the colours very nicely, and firſt mix them with one another, and then with the common matter of enamels: then ſet them in pots in a furnace; and when they are well mixed and incorporated, caſt them into water; and when dry, ſet them in a furnace again to melt; and when melted, take a proof of it. If too deep-coloured, add more of the common matter of enamels; and if too pale, add more of the colours.

Enamels are uſed either in counterfeiting or imitating precious ſtones, in painting in enamel; or by enamellers, jewellers, and goldſmiths, in gold, ſilver, and other metals. The two firſt kinds are uſually prepared by the workmen themſelves, who are employed in theſe arts. That uſed by jewellers, &c. is brought to us chiefly from Venice or Holland, in little cakes of different ſizes, commonly about four inches diameter, having the mark of the maker ſtruck upon it with a puncheon. It pays 1s. $7\frac{41}{100}$d. the pound on importation, and draws back 1s. $5\frac{70}{100}$d. at the rate of 4s. per pound.

ENAMELLING, the art of laying enamel upon metals, as gold, ſilver, copper, &c. and of melting it at the fire, or of making divers curious works in it at a lamp. It ſignifies alſo to paint in enamel.

The method of painting in ENAMEL. This is performed on plates of gold or ſilver, and moſt commonly of copper, enamelled with the white enamel; whereon they paint with colours which are melted in the fire, where they take a brightneſs and luſtre like that of glaſs. This painting is the moſt prized of all for its peculiar brightneſs and vivacity, which is very permanent, the force of its colours not being effaced or ſullied with time as in other painting, and continuing always as freſh as when it came out of the workmen's hands. It is uſual in miniature; it being the more difficult the larger it is, by reaſon of certain accidents it is liable to in the operation. Enamelling ſhould only be practiſed on plates of gold, the other metals being leſs pure: copper, for inſtance, ſcales with the application, and yields fumes; and ſilver turns the yellow white. Nor muſt the plate be made flat; for in ſuch caſe, the enamel cracks; to avoid which, they uſually forge them a little round or oval, and not too thick. The plate being well and evenly forged, they uſually begin the operation by laying on a couch of white enamel (as we obſerved above) on both ſides, which prevents the metal from ſwelling and bliſtering; and this firſt layer ſerves for the ground of all the other colours. The plate being thus prepared, they begin at firſt by drawing out exactly the ſubject to be painted with red vitriol, mixed with oil of ſpike, marking all parts of the deſign very lightly with a ſmall pencil. After this, the colours (which are to be before ground with water in a mortar of agate extremely fine, and mixed with oil of ſpike ſomewhat thick) are to be laid on, obſerving the mixtures and colours that agree to the different parts of the ſubject; for which it is neceſſary to underſtand painting in miniature. But here the workman muſt be very cautious of the good or bad qualities of the oil of ſpike he employs to mix his colours with, for it is very ſubject to adulterations.

Enamelling.

Great care muſt likewiſe be taken, that the leaſt duſt imaginable come not to your colours while you are either painting or grinding them; for the leaſt ſpeck, when it is worked up with it, and when the work comes to be put into the reverberatory to be made red hot, will leave a hole, and ſo deface the work.

When the colours are all laid, the painting muſt be gently dried over a ſlow fire to evaporate the oil, and the colours afterwards melted to incorporate them with the enamel, making the plate red-hot in a fire like what the enamellers uſe. Afterwards that part of the painting muſt be paſſed over again which the fire hath any thing effaced, ſtrengthening the ſhades and colours, and committing it again to the fire, obſerving the ſame method as before, which is to be repeated till the work be finiſhed.

Method of ENAMELLING *by the Lamp.* Moſt enamelled works are wrought at the fire of a lamp, in which, inſtead of oil, they put melted horſe-greaſe, which they called *caballine oil*. The lamp, which is of copper, or white iron, conſiſts of two pieces; in one of which is a kind of oval plate, ſix inches long, and two high, in which they put the oil and the cotton. The other part, called the *box*, in which the lamp is incloſed, ſerves only to receive the oil which boils over by the force of the fire. This lamp, or, where ſeveral artiſts work together, two or three more lamps are placed on a table of proper height. Under the table, about the middle of its height, is a double pair of organ-bellows, which one of the workmen moves up and down with his foot to quicken the flame of the lamps, which are by this means excited to an incredible degree of vehemence. Grooves made with a gauge in the upper part of the table, and covered with parchment, convey the wind of the bellows to a pipe of glaſs before each lamp; and that the enamellers may not be incommoded with the heat of the lamp, every pipe is covered at ſix inches diſtance with a little tin plate, fixed into the table by a wooden handle. When the works do not require a long blaſt,

Enamelling || Encaustic Painting.

blaſt, they only uſe a glaſs pipe, into which they blow with their mouth.

It is incredible to what a degree of fineneſs and delicacy the threads of enamel may be drawn at the lamp. Thoſe which are uſed in making falſe tufts of feathers are ſo fine, that they may be wound on the reel like ſilk or thread. The fictitious jets of all colours, uſed in embroideries, are alſo made of enamel; and that with ſo much art, that every ſmall piece hath its hole to paſs the thread through wherewith it is ſewed. Theſe holes are made by blowing them into long pieces; which they afterwards cut with a proper tool.

It is ſeldom that the Venetian or Dutch enamels are uſed alone: they commonly melt them in an iron ladle, with an equal part of glaſs or cryſtal; and when the two matters are in perfect fuſion, they draw it out into threads of different ſizes, according to the nature of the work. They take it out of the ladle while liquid, with two pieces of broken tobacco-pipes, which they extend from each other at arm's length. If the thread is required ſtill longer, then another workman holds one end, and continues to draw it out, while the firſt holds the enamel to the flame. Thoſe threads, when cold, are cut into what lengths the workman thinks fit, but commonly from 10 to 12 inches: and as they are all round, if they are required to be flat, they muſt be drawn through a pair of pinchers while yet hot. They have alſo another iron inſtrument in form of pinchers, to draw out the enamel by the lamp when it is to be worked and diſpoſed in figures. Laſtly, they have glaſs tubes of various ſizes, ſerving to blow the enamel into various figures, and preſerve the neceſſary vacancies therein; as alſo to ſpare the ſtuff, and form the contours. When the enameller is at work, he ſits before the lamp with his foot on the ſtep that moves on the bellows; and holding in his left hand the work to be enamelled, or the braſs or iron wires the figures are to be formed on, he directs with his right the enamel thread, which he holds to the flame with a management and patience equally ſurpriſing. There are few things they cannot make or repreſent with enamel: and ſome figures are as well finiſhed, as if done by the moſt ſkilful carvers.

ENARTHROSIS, in *Anatomy*, a ſpecies of DIARTHROSIS.

ENCÆNIA, the name of three ſeveral feſtivals celebrated by the Jews in memory of the dedication, or rather purification, of the temple, by Judas Maccabæus, Solomon, and Zorobbabel. This term is likewiſe uſed in church hiſtory for the dedication of Chriſtian churches.

ENCAMPMENT, the pitching of a CAMP.

ENCANTHIS, in *Surgery*, a tubercle ariſing either from the caruncula lachrymalis, or from the adjacent red ſkin; ſometimes ſo large, as to obſtruct not only the punctæ lachrymalia, but alſo part of the ſight or pupil itſelf. See SURGERY.

ENCAUSTIC and ENCAUSTUM, the ſame with enamelling and enamel. See ENAMELLING and ENAMEL.

Encaustic Painting, a method of painting made uſe of by the ancients, in which wax was employed to give a gloſs to their colours, and to preſerve them from the injuries of the air.

Encauſtic Painting.

This ancient art, after having been long loſt, was reſtored by Count Caylus, a member of the Academy of Inſcriptions in France; and the method of painting in wax was announced to the Academy of Painting and Belles Lettres in the year 1753; though M. Bachelier, the author of a treatiſe *De l'Hiſtoire et du Secret de la Peinture en Cire*, had actually painted a picture in wax in 1749; and he was the firſt who communicated to the public the method of performing the operation of inuſtion, which is the principal characteriſtic of the encauſtic painting. The Count kept his method a ſecret for ſome time, contenting himſelf with exhibiting a picture at the Louvre in 1754, repreſenting the head of Minerva, painted in the manner of the ancients, which excited the curioſity of the public, and was very much admired. In the interval of ſuſpenſe, ſeveral attempts were made to recover the ancient method of painting. The firſt ſcheme adopted was that of melting wax and oil of turpentine together, and uſing this compoſition as a vehicle for mixing and laying on the colours. But this method did not explain Pliny's meaning, as the wax is not burnt in this way of managing it. In another attempt, which was much more agreeable to the hiſtorian's deſcription of encauſtic painting, the wax was melted with ſtrong lixivium of ſalt of tartar, and with this the colours were ground. When the picture was finiſhed, it was gradually preſented to the fire, ſo as to melt the wax; which was thus diffuſed through all the particles of the colours, ſo that they were fixed to the ground, and ſecured from the acceſs of air or moiſture. But the method of Count Caylus is much more ſimple: the cloth or wood which he deſigned for the baſis of his picture, is waxed over, by only rubbing it ſimply with a piece of bees-wax; the wood or cloth, ſtretched on a frame, being held horizontally over, or perpendicularly before a fire, at ſuch a diſtance, that the wax might gradually melt, whilſt it is rubbed on, diffuſe itſelf, penetrate the body, and fill the interſtices of the texture of the cloth, which, when cool, is fit to paint upon; but as water-colours, or thoſe that are mixed up with common water, will not adhere to the wax, the whole picture is to be firſt rubbed over with Spaniſh chalk or white, and then the colours are applied to it; when the picture is dry, it is put near the fire, whereby the wax melts, and abſorbs all the colours.

Mr. J. H. Muntz, in a treatiſe on this ſubject, has propoſed ſeveral improvements in the art of encauſtic painting. When the painting is on cloth, he directs it to be prepared by ſtretching it on a frame, and rubbing one ſide ſeveral times over with a piece of bees-wax, or virgin wax, till it is covered with a coat of wax of conſiderable thickneſs. In fine linen, this is the only operation neceſſary previous to painting; but coarſe cloth muſt be rubbed gently on the unwaxed ſide with a pumice-ſtone, to take off all thoſe knots which would prevent the free and accurate working of the pencil. Then the ſubject is to be painted on the unwaxed ſide with colours prepared and tempered with water; and when the picture is finiſhed, it muſt be brought near the fire, that the wax may melt and fix the colours. This method, however, can only be applied to cloth or paper, through the ſubſtance of which the wax may paſs; but in wood, ſtone, metals,

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or plaſter, the former method of Count Caylus muſt be obſerved.

Mr Muntz has alſo diſcovered a method of forming grounds for painting with crayons, and fixing theſe, as well as water-colours employed with the pencil. On the unwaxed ſide of a linen cloth, ſtretched and waxed as before, lay an even and thick coat of the colour proper for the ground; having prepared this colour by mixing ſome proper pigment with an equal quantity of chalk, and tempering them with water. When the colour is dry, bring the picture to the fire, that the wax may melt, paſs through the cloth, and fix the ground. An additional quantity of wax may be applied to the back of the picture, if that which was firſt rubbed on ſhould not be ſufficient for the body of colour; but as this muſt be laid on without heat, the wax ſhould be diſſolved in oil of turpentine, and applied with a bruſh, and the canvas be again expoſed to the fire, that the freſh ſupply of wax may paſs through the cloth, and be abſorbed by the colour; and thus a firm and good body will be formed for working on with the crayons. If cloth and paper are joined together, the cloth muſt be firſt fixed to the ſtraining frame, and then the paper muſt be paſted to it with a compoſition of paſte made with wheaten flour, or ſtarch and water, and about a twelfth part of its weight of common turpentine. The turpentine muſt be added to the paſte when it is almoſt ſufficiently boiled, and the compoſition well ſtirred, and left to ſimmer over the fire for five or ſix minutes: let wax be diſſolved in oil of turpentine to the conſiſtence of a thin paſte: and when the cloth and paper are dry, let them be held near a fire; and with a bruſh lay a coat of the wax and turpentine on both ſides the joined cloth and paper, in ſuch a degree of thickneſs, that both ſurfaces may ſhine throughout without any appearance of dull ſpots. Then expoſe the cloth to the fire, or to the ſun; by which means the oil will evaporate, and the wax become ſolid, and be fit to receive any compoſition of colour for a ground, which is to be laid on as above directed in the caſe of cloth without paper.

Almoſt all the colours that are uſed in oil-painting may be alſo applied in the encauſtic method. Mr Muntz objects, indeed, to brown, light pink, and unburnt *terra di Sienna;* becauſe theſe, on account of their gummy or ſtony texture, will not admit ſuch a coheſion with the wax as will properly fix them; but other colours which cannot be admitted in oil painting, as red lead, red orpiment, cryſtals of verdegris, and red precipitate of mercury, may be uſed here. The crayons uſed in encauſtic painting are the ſame with thoſe uſed in the common way of crayon painting, excepting thoſe that in their compoſition are too tenacious; and the method of uſing them is the ſame in both caſes.

The encauſtic painting has many peculiar advantages: though the colours have not the natural varniſh or ſhining which they acquire with oil, they have all the ſtrength of paintings in oil, and all the airineſs of water-colours, without partaking of the apparent character or defects of either: they may be looked at in any light and in any ſituation, without any falſe glare: the colours are firm, and will bear waſhing; and a picture, after having been ſmoked, and then expoſed to the dew, becomes as clean as if it had been but juſt painted. It may alſo be retouched at pleaſure without any detriment to the colours; for the new colours will unite with the old ones, without ſpots, as is the caſe in common ſize painting; nor is it neceſſary to rub the places to be touched with oil as in oil pictures; it is not liable to crack, and eaſily repaired, if it ſhould chance to ſuffer any injury. The duration of this painting is alſo a very material advantage; the colours are not liable to fade and change; no damp can affect them, nor any corroſive ſubſtance injure them; nor can the colour fall off in ſhivers from the canvas. However notwithſtanding all theſe and other advantages enumerated by the Abbé Mazeas and Mr Muntz, this art has not yet been much practiſed. Many of theſe properties belong to a much higher ſpecies of encauſtic painting afterwards diſcovered in England, the colours of which are fixed by a very intenſe heat; nor are the colours or grounds on which they are laid liable to be diſſolved or corroded by any chemical menſtruum, nor, like the glaſſy colours of enamel, to run out of the drawing on the fire. What this method conſiſts in will appear from the following account communicated in a letter from Joſiah Colebrooke to the earl of Macclesfield, preſident of the Royal Society in 1759.

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"The art of painting with burnt wax (ſays he) has long been loſt to the world. The uſe of it to painters in the infancy of the art of painting was of the utmoſt conſequence. Drying oil being unknown, they had nothing to preſerve their colours entire from the injury of damps and the heat of the ſun: a varniſh of ſome ſort was therefore neceſſary; but they being unacquainted with diſtilled ſpirits, could not, as we now do, diſſolve gums to make a tranſparent coat for their pictures: this invention therefore of burnt wax ſupplied that defect to them; and with this manner of painting the chambers and other rooms in their houſes were furniſhed: this Pliny calls *encauſtum*, and we *encauſtic painting*.

"The following experiments which I have the honour to lay before your Lordſhip and the Society, were occaſioned by the extract of a letter from the Abbé Mazeas, tranſlated by Dr Parſons, and publiſhed in the ſecond part of the 49th volume of the Philoſophical Tranſactions, N° 100. concerning the ancient method of painting with burnt wax, revived by Count Caylus.

"The count's method was, 1. To rub the cloth or board deſigned for the picture ſimply over with beeswax. 2. To lay on the colours mixed with common water: but as the colours will not adhere to the wax, the whole picture was firſt rubbed over with (A) Spaniſh

(A) "Spaniſh chalk is called by Dr Parſons, in a note, *Spaniſh white*. This is a better kind of whitening than the common, and was the only white that had the name of *Spaniſh* annexed to it that I could procure, though I inquired for it at moſt if not all the colour ſhops in town.

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niſh chalk, and then the colours are uſed. 3. When the picture is dry, it is put near the fire, whereby the wax melts, and abſorbs all the colours.

" *Exp.* 1. A piece of oak board was rubbed over with bees-wax, firſt againſt the grain of the wood, and then with the grain, to fill up all the pores that remained after it had been planed, and afterwards was rubbed over with as much dry Spaniſh white as could be made to ſtick on it. This, on being painted (the colours mixed with water only), ſo clogged the pencil, and mixed ſo unequally with the ground, than it was impoſſible to make even an outline, but what was ſo much thicker in one part than another, that it would not bear ſo much as the name of painting; neither had it any appearance of a picture. However, to purſue the experiment, this was put at a diſtance from the fire, on the hearth, and the wax melted by ſlow degrees: but the Spaniſh white (though laid as ſmooth as ſo ſoft a body would admit, before the colour was laid on), on melting the wax into it, was not ſufficient to hide the grain of the wood, nor ſhow the colours by a proper whiteneſs of the ground; the wax, in rubbing on the board, was unavoidably thicker in ſome parts than in others, and the Spaniſh white the ſame: on this I ſuſpected there muſt be ſome miſtake in the Spaniſh white, and made the inquiry mentioned in the note (A).

" To obviate the inequality of the ground in the firſt experiment.

" *Exp.* 2. A piece of old wainſcot (oak-board) $\frac{1}{4}$th of an inch thick; which, having been part of an old drawer, was not likely to ſhrink on being brought near the fire: this was ſmoothed with a fiſh-ſkin; made quite warm before the fire; and then, with a bruſh dipped in white wax, melted in an earthen pipkin, ſmeared all over, and applied to the fire again. That the wax might be equally thick in all parts of the board, a ground was laid (on the waxed board) with levigated chalk mixed with gum-water (viz. gum-arabic diſſolved in water): When it was dry, I painted it with a kind of landſcape; and purſuing the method laid down by Count Caylus, brought it gradually to the fire. I fixed the picture on a fire-ſcreen, which would preſerve the heat, and communicate it to the back part of the board. This was placed firſt at the diſtance of three feet from the fire, and brought forwards by ſlow degrees, till it came within one foot of the fire, which made the wax ſwell and bloat up the picture; but as the chalk did not abſorb the wax, the picture fell from the board and left it quite bare.

" *Exp.* 3. I mixed three parts white wax, and one part white reſin, hoping the tenacity of the reſin might preſerve the picture. This was laid on a board heated with a bruſh as in the former; and the ground was chalk prepared as before. This was placed horizontally on an iron box, charged with a hot heater, ſhifting it from time to time, that the wax and reſin might penetrate the chalk; and hoping from this poſition, that the ground, bloated by melting the wax, would ſubſide into its proper place; but this, like the other, came from the board, and would not at all adhere.

" *Exp.* 4. Prepared chalk four drams, white wax, white reſin, of each a dram, burnt alabaſter half a dram, were all powdered together and ſifted, mixed with ſpirit of molaſſes inſtead of water, and put for a ground on a board ſmeared with wax and reſin, as in *Exp.* 3. This was alſo placed horizontally on a box-iron as the former: the picture bliſtered, and was cracked all over; and though removed from the box-iron to an oven moderately heated (in the ſame horizontal poſition), it would not ſubſide, nor become ſmooth. When it was cold, I took an iron ſpatula made warm, and moved it gently over the ſurface of the picture, as if I were to ſpread a plaiſter. (This thought occurred, from the board being prepared with wax and reſin, and the ground having the ſame materials in its compoſition, the force of the ſpatula might make them unite). This ſucceeded ſo well, as to reduce the ſurface to a tolerable degree of ſmoothneſs; but as the ground was broke off in many places, I repaired it with flake white, mixed up with the yoke of an egg and milk, and repainted it with molaſſes ſpirit (inſtead of water), and then put it into an oven with a moderate degree of heat. In this I found the colours fixed, but darker than when it was at firſt painted; and it would bear being waſhed with water, not rubbed with a wet cloth.

" *Exp.* 5. A board (that had been uſed in a former experiment) was ſmeared with wax and reſin, of each equal parts; was wetted with molaſſes ſpirit, to make whitening (or Spaniſh white) mixed with gum water adhere. This, when dry, was ſcraped with a knife, to make it equally thick in all places. It was put into a warm oven, to make the varniſh incorporate partly with the whitening before it was painted; and it had only a ſmall degree of heat: water was only uſed to mix the colours. This was again put into an oven with a greater degree of heat; but it flaked off from the board: whether it might be owing to the board's having had a ſecond coat of varniſh (the firſt having been ſcraped and melted off), and that the unctuous parts of the wax had ſo entered its pores, that it would not retain a ſecond varniſh, I cannot tell.

" *Exp.* 6. Having miſcarried in theſe trials, I took a new board, planed ſmooth, but not poliſhed either with a fiſh ſkin or ruſhes: I warmed it, and ſmeared it with wax only; then took *cimolia* (tobacco-pipe clay) diveſted of its ſand, by being diſſolved in water and poured off, leaving the coarſe heavy parts behind. After this was dried and powdered, I mixed it with a ſmall quantity of the yolk of an egg and cow's milk, and made a ground with this on the waxed board: this I was induced to try, by knowing that the yolk of an egg will diſſolve almoſt all unctuous ſubſtances, and make them incorporate with water; and I apprehended, that a ground thus prepared, would adhere ſo much the more firmly to the board than the former had done, as to prevent its flaking off. The milk, I thought, might

" My friend M. da Coſta ſhowed me a piece of Spaniſh chalk in his collection, which ſeemed more like a CIMOLIA (tobacco-pipe clay), and was the reaſon of my uſing that in one of the experiments.

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might anſwer two purpoſes; firſt, by uniting the ground with the wax; and ſecondly, by anſwering the end of ſize or gum-water, and prevent the colours from ſinking too deep into the ground, or running one into another. When the ground was near dry, I ſmoothed it with a pallet knife, and waſhed with milk and egg where I had occaſion to make it ſmooth and even: when dry I painted it, mixing the colours with common water; this, on being placed horizontally in an oven only warm enough to melt the wax, flaked from the board; but held ſo much better together than any of the former, that I paſted part of it on paper.

"*Exp.* 7. Flake-white (or the pureſt ſort of white-lead) mixed with egg and milk, crumbled to pieces in the oven, put on the waxed board, as in the laſt experiment.

"The bad ſucceſs which had attended all the former experiments, led me to conſider of what uſe the wax was in this kind of painting: and it occurred to me, that it was only as a varniſh to preſerve the colours from fading.

"In order to try this:

"*Exp.* 8. I took what the brick-layers call *fine ſtuff*, or *putty*, (B): to this I added a ſmall quantity of burnt alabaſter, to make it dry: this it ſoon did in the open air; but before I put on any colours, I dried it gently by the fire, leſt the colours ſhould run. When it was painted, I warmed it gradually by the fire (to prevent the ground from cracking) till it was very hot. I then took white wax three parts, white reſin one part; melted them in an earthen pipkin, and with a bruſh ſpread them all over the painted board, and kept it cloſe to the fire in a perpendicular ſituation, that what wax and reſin the plaſter would not abſorb might drop off. When it was cold, I found the colours were not altered, either from the heat of the fire, or paſſing the bruſh over them. I then rubbed it with a ſoft linen cloth, and thereby procured a kind of gloſs, which I afterwards increaſed by rubbing it with a hard bruſh; which was ſo far from ſcratching or leaving any marks on the picture, that it became more ſmooth and poliſhed by it.

"After I had made all the foregoing experiments, in converſation with my honoured and learned friend Dr Kidby, a fellow of this ſociety, I ſaid I had been trying to find out what the encauſtic painting of the ancients was. Upon which he told me, that there was a paſſage in Vitruvius *de Architectura* relative to that kind of painting: and was ſo good as to tranſcribe it for me from the 7th book, chap. 9. *De minii temperatura.* Vitruvius's words are: *At ſi quis ſubtilior fuerit, et voluerit expolitionem miniaceam ſuum colorem retinere, cum paries expolitus et aridus fuerit, tunc ceram Punicam liquefactam igni, paulo oleo temperatam, ſeta inducat, deinde poſtea carbonibus in ferreo vaſe compoſitis, eam ceram apprime cum pariete, calefaciendo ſudore cogat, fiatque ut peræquetur, deinde cum candela linteiſque puris fulgiat, uti ſigna marmorea nuda curantur. Hæc autem* καυσις *Græcè dicitur. Ita obſtans ceræ Punicæ lorica non patitur, nec lunæ ſplendorem, nec ſolis radios lambendo eripere ex his polutionibus colorem.*

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"Which I thus tranſlate: 'But if any one is more wary, and would have the poliſhing [painting] with vermilion hold its colour, when the wall is painted and dry, let him take Carthaginian [Barbary] wax, melted with a little oil, and rub it on the wall with a hair-pencil; and afterwards let him put live coals into an iron veſſel [chafing-diſh], and hold it cloſe to the wax, when the wall, by being heated, begins to ſweat; then let it be made ſmooth: afterwards let him rub it with a (C) candle and (D) clean linen rags, in the ſame manner as they do the naked marble ſtatues. This the Greeks call καυσις. The coat of Carthaginian wax (thus put on) is ſo ſtrong, that it neither ſuffers the moon by night, nor the ſun-beams by day, to deſtroy the colour.'

"Being ſatisfied, from this paſſage in Vitruvius, that the manner of using wax in *Exp.* 8. was right, I was now to find if the wax-varniſh, thus burnt into the picture, would bear waſhing. But here I was a little diſappointed; for rubbing one corner with a wet linen cloth, ſome of the colour came off; but waſhing it with a ſoft hair-pencil dipped in water, and letting it dry without wiping, the colour ſtood very well.

"A board painted, as in *Exp.* 8. was hung in the moſt ſmoky part of a chimney for a day, and expoſed to the open air in a very foggy night. In the morning the board was ſeemingly wet through, and the water ran off the picture. This was ſuffered to dry without wiping: and the picture had not ſuffered at all from the ſmoke or the dew, either in the ground or the colours; but when dry, by rubbing it, firſt with a ſoft cloth, and afterwards with a bruſh, it recovered its former gloſs.

"Suſpecting that ſome tallow might have been mixed with the white wax I had uſed, which might cauſe the colours to come off on being rubbed with a wet cloth, I took yellow wax which had been melted from the honeycomb in a private family, and conſequently not at all adulterated: to three parts of this I added one part reſin, and melted them together.

"*Exp.* 9. Spaniſh-white, mixed with fiſh-glue, was put for a ground on a board, and painted with water-colours only. The board was made warm; and then the wax and reſin were put on with a bruſh, and kept cloſe to the fire till the picture had imbibed all the varniſh,

(B) "Putty is lime flaked, and while warm, diſſolved in water, and ſtrained through a ſieve.

(C) "The account of the method of poliſhing [painting] walls coloured with vermilion, gave me great ſatisfaction, as it proved the method I had taken in experiment 8. (which I had tried before I ſaw or knew of this paſſage in Vitruvius) was right. The uſe of the candle, as I apprehend, was to melt the wax on the walls where by accident the bruſh had put on too much, or afford wax where the bruſh had not put on enough, or had left any part bare.

(D) "The rubbing the wall with a linen cloth, while warm, will do very well where there is only one colour to be preſerved; but where there are many, as in a landſcape, it will be apt to take off ſome, or render the colouring rather faint; which I found by wiping the wax off from a painting while it was hot.

Encauſtic. varniſh, and looked dry. When it was cold, I rubbed it firſt with a linen cloth, and then poliſhed it with a hard bruſh.

" In theſe experiments I found great difficulties with regard to colours. Many water colours being made from the juices of plants, have ſome degree of an acid in them; and theſe, when painted on an alkaline ground, as chalk, whitening, *cimolia*, and plaſter, are totally changed in their colours, and from green become brown; which contributes much to make the experiments tedious. I would therefore adviſe the uſe of mineral or metallic colours for this ſort of painting, as moſt likely to preſerve their colour: for although I neutralized Spaniſh white, by fermenting it with vinegar, and afterwards waſhed it very well with water, it did not ſucceed to my wiſh.

" Theſe experiments, and this paſſage from Vitruvius, will in ſome meaſure explain the obſcurity of part of that paſſage in Pliny which Dr Parſons, in his learned comment on the encauſtic painting with wax, ſeems to deſpair of.

" *Ceris pingere*, was one ſpecies of encauſtic painting. Ενκαυστον, *inuſtum*, may be tranſlated, " forced in by the means of fire; burnt in:" for whatever is forced in by the help of fire can be rendered into Latin by no other ſignificant word that I known of but *inuſtum*. If this is allowed me, and I think I have the authority of Vitruvius (a writer in the Auguſtan age) for it, who ſeems to have wrote from his own knowledge, and not like Pliny, who copied from others much more than he knew himſelf, the difficulty with regard to this kind of painting is ſolved, and the encauſtic with burnt wax recovered to the public.

" What he means by the next kind he mentions, *in ebore ceſiro id eſt viriculo*, I will not attempt to explain at preſent.

" The ſhip-painting is more eaſily accounted for, the practice being in part continued to this time; and is what is corruptly called *breaming*, for brenning or burning.

" This is done by reeds ſet on fire, and held under the ſide of a ſhip till it is quite hot; then reſin, tallow, tar, and brimſtone, melted together, and put on with a hair bruſh while the planks remain hot, make ſuch a kind of paint as Pliny deſcribes: which, he ſays, *nec ſole, nec ſale ventiſque corrumpitur*. As they were ignorant of the uſe of oil-painting, they mixed that colour with the wax, &c. which they intended for each particular part of the ſhip, and put it on in the manner above deſcribed.

" In the pictures painted for theſe experiments, and now laid before your lordſhip and the ſociety, I hope neither the deſign of the landſcape, nor the execution of it, will be ſo much taken into conſideration as the varniſh (which was the thing wanted in this inquiry): and I think that will evince, that the encauſtic painting with burnt wax is fully reſtored by theſe experiments; and though not a new invention, yet having been loſt for ſo many ages, and now applied further, and to other purpoſes, than it was by Vitruvius (who confined it to vermilion only), may alſo amount to a new diſcovery, the uſe of which may be a means of preſerving many curious drawings to poſterity; for this kind of painting may be on paper, cloth, or any other ſubſtance that will admit a ground to be laid on it. The proceſs is very ſimple, and is not attended with the diſ- Encauſtic.
agreeable ſmell unavoidable in oil-painting, nor with ſome inconveniences inſeparable from that art; and as there is no ſubſtance we know more durable than wax, it hath the greateſt probability of being laſting."

Still, however, there ſeem to have been ſome defects or inconveniences attending theſe and other ſubſequent attempts: for we find the ancient or ſome ſimilar method of painting in wax remaining a deſideratum upwards of 25 years after the publication of the preceding experiments; when in 1787 a method was communicated to the Society of Arts by Miſs Greenland, for which ſhe was rewarded with a prize. The ground of her information ſhe received at Florence, through the acquaintance of an amateur of painting, who procured her the ſatisfaction of ſeeing ſome paintings in the ancient Grecian ſtyle, executed by Signora Parenti, a profeſſor at that place, who had been inſtructed by a Jeſuit at Pavia, the perſon who made the fartheſt diſcoveries in that art. Miſs Greenland's friend knowing ſhe was fond of painting, informed her what were the materials the paintreſs uſed, but could not tell her the proportions of the compoſition; however, from her anxiety to ſucceed in ſuch an acquiſition, ſhe made various experiments, and at laſt obtained ſuch a ſufficient knowledge of the quantities of the different ingredients as to begin and finiſh a picture, which ſhe afterwards preſented to the Society for their inſpection.

Her method is as follows: " Take an ounce of white wax, and the ſame weight of gum maſtich powdered. Put the wax in a glazed earthen veſſel over a very ſlow fire; and when it is quite diſſolved, ſtrew in the maſtich, a little at a time, ſtirring the wax continually until the whole quantity of gum is perfectly melted and incorporated: then throw the paſte into cold water; and when it is hard, take it out of the water, wipe it dry, and beat it in one of Mr Wedgwood's mortars, obſerving to pound it at firſt in a linen cloth to abſorb ſome drops of water that will remain in the paſte, and would prevent the poſſibility of reducing it to a powder, which muſt be ſo fine as to paſs through a thick gauze. It ſhould be pounded in a cold place and but a little while at a time, as after long beating the friction will in a degree ſoften the wax and gum, and inſtead of their becoming a powder they will return to a paſte.

" Make ſome ſtrong gum-arabic water; and when you paint, take a little of the powder, ſome colour, and mix them together with the gum-water. Light colours require but a ſmall quantity of the powder, but more of it muſt be put in proportion to the body and darkneſs of the colours; and to black there ſhould be almoſt as much of the powder as colour.

" Having mixed the colours, and no more than can be uſed before they grow dry, paint with fair water, as is practiſed in painting with water-colours, a ground on the wood being firſt painted of ſome proper colour prepared in the ſame manner as is deſcribed for the picture; walnut-tree and oak are the ſorts of wood commonly made uſe of in Italy for this purpoſe. The painting ſhould be very highly finiſhed; otherwiſe, when varniſhed, the tints will not appear united.

" When the painting is quite dry, with rather a hard bruſh, paſſing it one way, varniſh it with white wax, which is put into an earthen veſſel, and kept melted over a very ſlow fire till the picture is varniſhed, taking

Enceinte ‖ Enchasing.

king great care the wax does not boil. Afterwards hold the picture before a fire, near enough to melt the wax, but not make it run; and when the varnish is entirely cold and hard, rub it gently with a linen cloth. Should the varnish blister, warm the picture again very slowly, and the bubbles will subside. When the picture is dirty, it need only be washed with cold water."

The opinion given by the Society upon the above is: The method made use of by Miss Greenland provides against all inconveniences; and the brilliancy of the colours in the picture painted by her, and exhibited to the Society, fully justifies the opinion, that the art of painting in wax, as above described, highly merited the reward of a gold pallet voted to her on this occasion.

ENCEINTE, in *Fortification*, is the wall or rampart which surrounds a place, sometimes composed of bastions or curtains, either faced or lined with brick or stone, or only made of earth. The enceinte is sometimes only flanked by round or square towers, which is called a *Roman wall*.

ENCEPHALI, in *Medicine*, worms generated in the head, where they cause so great a pain as sometimes to occasion distraction.

The encephali are very rare; but there are some diseases wherein they swarm: from whence we are told pestilential fevers have wholly arisen. Upon the dissection of one who died of this fever, a little, short, red worm was found in the head, which malmsey wine, wherein horse-radish had been boiled, could alone destroy. This medicine was afterwards tried on the sick, most of whom it cured.

The like worms have also been taken out by trepanning, and the patient cured. Those worms that generate in the nose, ears, and teeth, are also called *encephali*.

ENCHANTER, a person supposed to practise enchantment or fascination. See FASCINATION, WITCHCRAFT, &c.

Enchanter's Nightshade. See CIRCÆA, BOTANY *Index*.

ENCHASING, INCHASING, or *Chasing*, the art of enriching and beautifying gold, silver, and other metal-work, by some design or figures represented thereon in low relievo.

Enchasing is practised only on hollow thin works, as watch-cases, cane-heads, tweezer-cases, or the like. It is performed by punching or driving out the metal, to form a figure, from withinside, so as to stand out prominent from the plane or surface of the metal. In order to this, they provide a number of fine steel blocks or puncheons of divers sizes; and the design being drawn on the surface of the metal, they apply the inside upon the heads or tops of these blocks, directly under the lines or parts of the figures; then, with a fine hammer, striking on the metal, sustained by the block, the metal yields, and the block makes an indenture or cavity on the inside, corresponding to which there is a prominence on the outside, which is to stand for that part of the figure.

Thus the workman proceeds to chase and finish all the parts by the successive application of the block and hammer to the several parts of the design. And it is wonderful to consider with what beauty and justness, by this simple piece of mechanism, the artists in this kind will represent foliages, grotesques, animals, histories, &c.

Enclitic ‖ Endym

ENCLITICA, in *Grammar*, particles which are so closely united with other words as to seem part of them, as in *virumque*, &c.—There are three enclitic particles in Latin, viz. *que*, *ne*, *ve*.

ENCRATITES, in church-history, heretics who appeared towards the end of the second century: they were called *Encratites*, or *Continentes*, because they gloried in abstaining from marriage and the use of wine and animal food.

ENCURECK, in *Natural History*, a venomous insect found in Persia, and said to be a kind of tarantula. According to Olearius, as quoted by Mr Boyle, it neither stings nor bites; but lets fall its venom like a drop of water, which causes insufferable pain in the part for a time, and afterwards so profound a sleep, that, as report says, nothing can awake the patient except crushing one of the creatures on the part affected. It is nevertheless said, that the sheep eat these insects without damage.

ENCYCLOPÆDIA, a term nearly synonymous with CYCLOPÆDIA; but adopted in preference to it in denominating the present work, as being more definite and of better authority. According to an observation of the late learned printer Mr Bower, the preposition EN makes the meaning of the word more precise. For *Cyclopædia* may denote "the instruction OF a circle," as *Cyropædia* is "the instruction OF Cyrus," whereas in *Encyclopædia* the preposition determines the word to be from the dative of *cyclus*, "instruction IN a circle." And Vossius, in his book *De vitiis sermonis*, has observed, "That *Cyclopædia* is used by some authors, but *Encyclopædia* by the best."

ENDEMIC, or ENDEMICAL, DISEASES, those to which the inhabitants of particular countries are subject more than others, on account of the air, water, situation, and manner of living.

ENDIVE. See CICHORIUM, BOTANY and GARDENING *Index*.

ENDLESS, something without an end: thus authors mention endless rolls, the endless screw, &c.

ENDOR, in *Ancient Geography*, a town of Galilee, four miles to the south of Mount Tabor, in the tribe of Manasseh, where the Pythoness was consulted by Saul: at this day, says Jerome, a large village.

ENDORSE, in *Heraldry*, an ordinary, containing the eighth part of a pale, which Leigh says is only used when a pale is between two of them.

ENDORSED, in *Heraldry*, is said of things borne back to back, more usually called ADOSSE.

ENDORSEMENT, in *Law* and *Commerce*. See INDORSEMENT.

ENDOWMENT, in *Law*, denotes the settling a dower on a woman; though sometimes it is used figuratively, for settling a provision upon a parson, on the building of a church; or the severing a sufficient portion of tithes for a vicar, when the benefice is appropriated.

ENDYMION, in fabulous history, a shepherd, son of Æthlius and Calyce. It is said that he required of Jupiter to grant to him to be always young, and to sleep as much as he would; whence came the proverb of *Endymionis somnum dormire*, to express a long sleep. Diana saw him naked as he slept on Mount Latmos; and

and was so struck with his beauty, that she came down from heaven every night to enjoy his company. Endymion married Chromia daughter of Itonus; by whom he had three sons Pæon, Epeus, and Æolus, and a daughter called *Eurydice*. The fable of Endymion's amours with Diana, or the moon, arose from his knowledge of astronomy; and as he passed the night on some high mountain to observe the heavenly bodies, it came to be reported that he was courted by the moon. Some suppose that there were two of that name; the son of a king of Elis, and the shepherd or astronomer of Caria. The people of Heraclea maintained that Endymion died on Mount Latmos; and the Eleans pretended to show his tomb at Olympia in Peloponnesus.

ENEMY, in *Law*, an alien or foreigner, who publicly invades the kingdom.

ENERGUMENS, in church-history, persons supposed to be possessed by the devil, concerning whom there were many regulations among the primitive Christians. They were denied baptism and the eucharist; at least, this was the practice of some churches: and though they were under the care of exorcists, yet it was thought a becoming act of charity to let them have the public prayers of the church, at which they were permitted to be present. See EXORCISM.

ENERGY, a term of Greek origin, signifying the power, virtue, or efficacy of a thing. It is also used, figuratively, to denote emphasis of speech.

ENERVATING, the act of destroying the force, use, or office, of the nerves, either by cutting them, by weakening them with debauchery, or by some other violence.

Excess of wine, and other strong, hot, spirituous liquors, enervate or weaken the nerves. When they would render a horse useless, they enervate him, or cut his nerves.

ENFANS PERDUS, the same with forlorn hope. See FORLORN.

ENFIELD, WILLIAM, LL. D. an elegant and very justly admired writer, was born in the year 1741, at Sudbury. His original destination was for the sacred office of the ministry, and he was educated among the protestant dissenters at Daventry, where the high polish which he gave to his compositions, distinguished him from many of his cotemporaries. The congregation of Benn's-garden of Liverpool made choice of him for their minister in the year 1763, when he was not more than 22 years of age; and in this situation he was soon taken notice of as an amiable member of society, and an engaging preacher. While he resided in Liverpool, he published two volumes of sermons, 12mo, as well as a collection of hymns and family prayers, which met with a very favourable reception. In the year 1770, he was appointed tutor and lecturer in the belles lettres at Warrington academy, which he filled for some years with general approbation and unwearied diligence. He was the compiler of many useful books, among the most popular of which we may rank his "Speaker," composed of pieces of recitation from the best and most approved English authors. At the beginning of this collection there is an excellent essay on elocution. The Preacher's Directory; the English Preacher, a collection of sermons in 9 vols 12mo, from the most celebrated authors; Biographical Sermons on the principal characters in the Old and New Testament, with a number of single sermons on particular occasions, were also the productions of his pen. The controversy relative to literary property also engaged his attention, and on this he wrote a quarto pamphlet. He likewise published in one volume 4to, Institutes of Natural Philosophy, theoretical and experimental; and during the time of his residence at Warrington, as teacher in the academy, the university of Edinburgh conferred on him the degree of LL. D. When that academy was dissolved in 1783, Dr Enfield continued for two years at Warrington in the capacity of a private tutor, after which he was chosen pastor of the Octagon meeting-house at Norwich, in the year 1785. He at length gave up his private tuition, and entirely devoted his time to literary labours, and the peculiar duties of his pastoral charge. About this time he lost his eldest son, who had been appointed to the office of town-clerk of Nottingham. This event would have been productive of very serious effects on his health and spirits, had it not been for the consolation of religion and philosophy, which are sufficient to support the human mind under the pressure of the severest calamities. He undertook and executed the laborious task of abridging Brucker's History of Philosophy, which in 1791 he published in 2 vols 4to. It has been allowed that the tenets of the different sects of philosophers were never before exhibited to the world with such perspicuity and elegance; qualifications for which Dr Enfield was undoubtedly eminent. He contributed largely to the Biographical Dictionary, published under the inspection of Dr Aiken and others.

An unsuspected distemper hastened the termination of his useful life, and on the 3d of November 1797, he expired in the 57th year of his age. The general love of mankind which Dr Enfield possessed, falls to the lot of few; nor does it often happen, that an individual dies so universally lamented. It was essential to him to be amiable in every station and condition of life. His posthumous sermons in 3 vols 8vo, had a very numerous list of subscribers, a strong proof of the estimation in which he was held by all who knew him, either personally or by report. In these discourses he treats chiefly on moral topics, which he discusses with the nicest discrimination, and in a train of the most pleasing and manly eloquence.

ENFILADE, in the art of war, is used in speaking of trenches, or other places, which may be scoured by the enemy's shot along their whole length. In conducting the approaches at a siege, care must be taken that the trenches be not enfiladed from any work of the place.

ENFINE', formerly ANTINOE, a city of Egypt, built by Adrian in honour of his favourite Antinous. It is situated towards the middle of the Said, or Upper Egypt, and still contains several stately monuments of antiquity. In ancient times this city was very magnificent. It was about half a league in circumference, having two principal streets 45 feet wide, intersecting each other at right angles, and running through its whole length. The others were more narrow, but equally straight; the two largest having gates at each end, part of which still remain. According to the Nubian geographer, it was called the city of the Magi, because Pharaoh is said to have caused the magicians

Enfine ‖ Engendering.

come from thence to his court. Near it were the ruins of Abydus, where there was an oracle of the god Beſa, one of the moſt ancient in Egypt, and which was ſtill famous in the time of Conſtantius; and hence ſome have derived the appellation juſt mentioned, the neighbouring people coming in crowds to conſult the oracle.

The ruins of the gates are the moſt beautiful pieces of architecture to be met with in this place. The handſomeſt has three vaulted entries; the middle one being 40 feet in height, 22 wide, and 20 thick; the other two ſmaller. Each of the facades of this edifice is ornamented with four pilaſters in bas relief, with Corinthian capitals, the acanthus leaves of which have a conſiderable projection. It was ſurrounded by eight Corinthian columns, of which only one now remains, but the pedeſtals of the reſt are ſtill entire. Beſides theſe, there are heaps of rubbiſh in different parts of the town, apparently the remains of ancient temples or palaces. All theſe ſeem to have been bordered by a colonnade, forming a portico on each ſide, where the inhabitants might walk ſecure from the heat of the ſun. One of the ſquares was ornamented with four large Corinthian pillars, three of which are deſtroyed all but the baſes. The fourth is quite entire, about 50 feet high, and the ſhaft compoſed of ſeveral ſtones. The pedeſtal has a Greek inſcription, pretty much defaced, dedicating it to the emperor Alexander Severus, to whom the ſenate of ALEXANDRIA had already dedicated the famous column mentioned under that article. Theſe four other columns were therefore probably raiſed in honour of that emperor after his victories over the Perſians; for the foliage of the oak, with which the firſt ſtone of the ſhaft is decorated, was a ſign of victory among the Romans. Towards the end of the fourth century the city was peopled by Chriſtians; and Palladius aſſures us, that there were at that place 12 convents of virgins, and ſeveral others inhabited by monks. In the convents there are ſtill ſeveral Coptic monaſteries poſſeſſed by monks equally miſerable and ignorant. The Nubian geographer informs us, that the city was ſurrounded by a well cultivated country, abounding in fruits and harveſts; but theſe have now given place to ſands and barren deſerts. The ruins of Abydus above mentioned are ſtill to be ſeen near this place.

ENFRANCHISEMENT, in *Law*, the incorporating a perſon into any ſociety or body-politic.

ENGASTRIMYTHI, in Pagan theology, the Pythians, or prieſteſſes of Apollo, who delivered oracles from within, without any action of the mouth or lips.

The ancient philoſophers, &c. are divided upon the ſubject of the engaſtrimythi. Hippocrates mentions it as a diſeaſe. Others will have it a kind of divination. Others attribute it to the operation or poſſeſſion of an evil ſpirit. And others to art and mechaniſm. M. Scottus maintains that the engaſtrimythi of the ancients were poets, who, when the prieſts could not ſpeak, ſupplied the defect by explaining in verſe what Apollo dictated in the cavity of the baſon on the ſacred tripod.

ENGENDERING, a term ſometimes uſed for the act of producing or forming any thing: thus meteors are ſaid to be engendered in the middle region of the atmoſphere, and worms in the belly.

ENGINE, in *Mechanics*, is a compound machine, made of one or more mechanical powers, as levers, pulleys, ſcrews, &c. in order to raiſe, caſt, or ſuſtain any weight, or produce any effect which could not be eaſily effected otherwiſe. The word is formed of the French *engin*, from the Latin *ingenium*, "wit;" by reaſon of the ingenuity required in the contrivance of engines to augment the effect of moving powers. Engin ‖ Englan

Engine for Extinguiſhing Fires. See HYDROSTATICS *Index*.

Pile-Engine, one contrived for driving piles. See *PILE-Engine*.

Steam-Engine, a machine to raiſe water by fire, or rather by the force of water turned into ſteam. See *STEAM-Engine*.

ENGINEER, in the military art, an able expert man, who, by a perfect knowledge in mathematics, delineates upon paper, or marks upon the ground, all ſorts of forts, and other works proper for offence and defence. He ſhould underſtand the art of fortification, ſo as to be able, not only to diſcover the defects of a place, but to find a remedy proper for them; as alſo how to make an attack upon, as well as to defend, the place. Engineers are extremely neceſſary for theſe purpoſes: wherefore it is requiſite, that beſides being ingenious, they ſhould be brave in proportion. When at a ſiege, the engineers have narrowly ſurveyed the place, they are to make their report to the general, by acquainting him which part they judge the weakeſt, and where approaches may be made with moſt ſucceſs. Their buſineſs is alſo to delineate the lines of circumvallation and contravallation, taking all the advantages of the ground; to mark out the trenches, places of arms, batteries, and lodgments, taking care that none of their works be flanked or diſcovered from the place. After making a faithful report to the general of what is a-doing, the engineers are to demand a ſufficient number of workmen and utenſils, and whatever elſe is neceſſary.

ENGLAND, the ſouthern diviſion of the iſland of Great Britain. Including Wales, it is of a triangular form, and lies between the 50th and 55th degrees of north latitude, extending about 400 miles in length from ſouth to north, and in ſome places it is 300 miles in breadth. It is bounded by Scotland on the north; by the Engliſh Channel on the ſouth, dividing it from France; by the German ſea on the eaſt; and on the weſt by St George's, or the Iriſh Channel.

I

When people

At what time the iſland of Britain was peopled is uncertain; nor do we know whether the ſouthern or northern parts were firſt inhabited. We have no accounts that can be depended upon before the arrival of Julius Cæſar, and it is certain he found the ſouthern parts full of people of a very warlike diſpoſition. Theſe people, according to Cæſar, were a colony of the Gauls; and this opinion is embraced by moſt of the ancient as well as modern writers. It is chiefly founded on the agreement obſerved by the Romans between the two nations in their cuſtoms, manners, language, religion, government, way of fighting, &c. The more northern inhabitants, according to Tacitus, came from Germany. This he infers from the make of their limbs; but Cæſar ſimply calls them *Aborigenes*.

England,

England.

England, including the principality of Wales, when first invaded by the Romans, was divided into 17 petty states.

2 Inhabited by 17 different nations.

1. The Dannonii, called also *Dumnonii* and *Donmonii*, inhabiting the counties of Cornwall and Devonshire. 2. The Durotriges, who inhabited the tract now called *Dorsetshire*. 3. The Belgæ possessed Somersetshire, Wiltshire, and Hampshire. 4. The Attrebatii, or inhabitants of Berkshire. 5. The Regni, whose country bordered on that of the Attrebatii, and comprehended Surrey, Sussex, and part of the sea-coast of Hampshire. 6. The Cantii, inhabiting the county now called *Kent*. 7. The Dobuni are placed by Ptolemy on the north side of the Thames, near its head, in the counties of Gloucestershire and Oxfordshire. 8. The Cattieuchlani, *Calyeuchlani*, *Cattidudani*, or *Cathieludani*, inhabited Buckinghamshire, Bedfordshire, and Hertfordshire. 9. The Trinobantes, who possessed the counties of Essex and Middlesex. 10. The Iceni, whose country comprehended Suffolk, Norfolk, Cambridge, and Huntingdonshire. These are by Ptolemy called *Simeni*, and by others *Tigeni*. Camden is of opinion, that they were the same whom Cæsar calls *Cenomagni*. 11. The Coritani, whose country comprehended Northamptonshire, Leicestershire, Rutlandshire, Lincolnshire, Nottinghamshire, and Derbyshire. 12. The Cornavii possessed Warwickshire, Worcestershire, Staffordshire, Shropshire, and Cheshire. 13. The Silures inhabited the counties of Radnorshire, Brecknockshire, Glamorganshire, with Herefordshire and Monmouthshire. 14. The Demetæ inhabited part of Caermarthenshire, Pembrokeshire, and Cardiganshire. 15. The country of the Ordovices comprehended Montgomeryshire, Merionethshire, Caernarvonshire, Denbighshire, and Flintshire. 16. The Brigantes possessed the counties of Yorkshire, the bishopric of Durham, Lancashire, Westmorland, and Cumberland. 17. The county of Northumberland was held by the Ottadini, Ottadeni, or Ottalini. Their country, according to some, reached from the Tyne to the river Forth; though the most common opinion is, that it reached only to the Tweed.

The above-mentioned names of these nations are plainly Roman, but the etymology of them is not easily ascertained. Some attempt to derive them from words in the old British language; but as this subject at best must be very obscure and uncertain, we shall not enter into it.

3 Julius Cæsar undertakes an expedition into Britain.

Before the time of Julius Cæsar, the Romans had scarcely any knowledge of Britain; but that conqueror having subdued most of the Gallic nations on the opposite side of the channel, began to think of extending his conquests by the reduction of Britain. The motive for this expedition, ascribed to him by Suetonius, was a desire of enriching himself with the British pearls, which were then very much esteemed. The pretence, however, which he made use of in order to justify his invasion was, that the Britons had sent assistance to the Gauls during his wars with them.

Cæsar undertook his first expedition against Britain when the summer was already far spent, and therefore he did not expect to finish the conquest of the country that campaign. He thought, however, that it would be a considerable advantage to view the island, and learn something of the manners and customs of the natives; after which he could more easily take such measures as would ensure a permanent conquest on his return. Having marched all his forces into the country of the Morini, now the province of Picardy, from whence was the shortest passage into Britain; he ordered at the same time all the vessels that lay in the neighbouring ports, and a fleet which he had built the year before for an expedition against the Morini, to attend him. The Britons, alarmed at his preparations, sent ambassadors with offers of submission; but Cæsar, though he received them with great kindness, did not abandon his intended scheme of an invasion. He waited till the arrival of C. Volusenus, whom he had sent out with a single galley to make discoveries on the coast. Volusenus did not think proper to land; but, having made what observations he could, returned after five days absence, and Cæsar immediately set sail for Britain. His force consisted of two legions, embarked on board 80 transports; and he appointed 18 more which lay wind-bound about eight miles off, to convey over the cavalry; but these last orders were too slowly executed, which occasioned some difficulty in his landing. England.

4 Manners customs, &c. of the Britons.

The Britons at this time, according to Cæsar and other Roman historians, were very numerous, and had their country well stocked with cattle. Their houses resembled those of the Gauls; and they used copper or iron plates weighed by a certain standard instead of money. Their towns were a confused parcel of huts placed at a small distance from one another, generally in the middle of a wood, to which all the avenues were slightly guarded with ramparts of earth, or with trees. All the nations were in a state of the most wretched barbarism, even when compared with the barbarous Gauls on the continent. The use of clothes was scarcely known in the island. Only the inhabitants of the southern coast covered their nakedness with the skins of wild beasts; and this rather to avoid giving offence to the strangers who came to trade with them, than out of any principle of decency. It was a general custom among the Britons to paint their bodies with the juice of woad: but whether this was designed as ornament, or for any other purpose, is not known. They shaved their beards all except their upper lip, and wore long hair. They also had their wives in common, a custom which made them detestable to all other nations.

The arms of the Britons were a sword, a short lance, and a shield. Breast-plates and helmets they looked upon rather to be incumbrances, and therefore made no use of them. They usually fought in chariots, some of which were armed with scythes at the wheels; they were fierce and cruel, and exceedingly bloodthirsty. When driven to distress, they could subsist themselves even on the bark and roots of trees; and Dio Cassius tells us, that they had ready, on all occasions, a certain kind of food, of which, if they took but the quantity of a bean, they were not troubled with hunger or thirst for a considerable time after. The southern nations, however, were somewhat more civilized; and the Cantii, or inhabitants of Kent, more so than any of the rest.

All the British nations at this time were very brave and resolute, owing to the continual dissensions among themselves. They proved therefore very formidable enemies to the Romans; but the same dissensions which had

England. had taught them the art of war, alſo prevented them from uniting in the defence of their country. As ſoon as they perceived Cæſar's fleet approaching, a number of cavalry and chariots were diſpatched to oppoſe his landing, while a conſiderable body of infantry haſtened after. What chiefly embarraſſed the Romans in their attempt to land, was the largeneſs of their ſhips, which required a conſiderable depth of water. The ſoldiers, therefore, were obliged to leap into the ſea while loaded with their armour; and at the ſame time to encounter the enemy, who were quite diſengaged, as they either ſtood on dry ground, or waded but a little way into the water. Cæſar perceiving this diſadvantage, ordered his galleys to advance, with their broadſides towards the ſhore, in order to drive the Britons from the water-ſide with their ſlings and arrows. On this the Britons, ſurpriſed at the galleys, a ſort of ſhipping they had never before ſeen, began to give ground. The fight, however, continued for ſome time, greatly to the diſadvantage of the Romans; till at laſt Cæſar, obſerving the diſtreſs of his men, cauſed ſeveral boats to be manned, and ſent them to the aſſiſtance of thoſe who were moſt expoſed to the enemy's aſſault. The Romans then ſoon got the better of the undiſciplined barbarians, however brave, and made good their landing; but they were unable to purſue the enemy for want of cavalry, which had not yet arrived.

5 They oppoſe Cæſar's landing.

6 They are defeated and ſue for peace.

The Britons were ſo diſheartened with this bad ſucceſs, that they immediately ſent ambaſſadors to ſue for peace; which was granted, on condition of their delivering a certain number of hoſtages for their fidelity. Part of theſe they brought immediately; and promiſed to return in a few days with the reſt, who, they ſaid, lived at ſome diſtance. But, in the mean time, the 18 tranſports which carried Cæſar's cavalry, being driven back by a violent ſtorm, and the fleet which lay in the road being greatly damaged by the ſame, the Britons thought proper to break their engagements. Having therefore privately aſſembled their forces, they fell unexpectedly on the ſeventh legion while at a diſtance from the reſt and buſied in foraging. Cæſar being appriſed of their danger, haſtened to their aſſiſtance with two cohorts, and at laſt repulſed the enemy.—This, however, proved only a temporary deliverance; for the Britons, thinking it would be poſſible for them to cut off all the Romans at once, diſpatched meſſengers to inform ſeveral of the neighbouring nations of the weakneſs of the enemy's forces, and the happy opportunity that offered itſelf of deſtroying all theſe invaders at one blow.—On this, they drew together a great body of horſe and foot, which boldly advanced to the Roman intrenchments. But Cæſar came out to meet them; and the undiſciplined Britons being by no means able to cope with the Romans, were put to flight with great ſlaughter. Having burnt ſeveral towns and villages, the victors returned to their camp, where they were ſoon followed by new deputies from the Britons. Cæſar being in want of horſe, and afraid leſt another ſtorm ſhould deſtroy the remainder of his fleet, granted them peace on condition of their ſending him double the number of hoſtages into Gaul which they had before promiſed. The ſame night he ſet ſail, and ſoon arrived ſafe in Gaul.

7 Their treachery.

The Britons no ſooner perceived the Romans gone, than, as before, they broke through their engagements. Of all the ſtates who had promiſed to ſend hoſtages, only two performed their promiſes; and this neglect ſo provoked Cæſar, that he determined to return the year following with a far greater force. Having, therefore, cauſed his old veſſels to be refitted, and a great many new ones to be built, he arrived off the coaſt of Britain with a fleet of 600 ſhips and 28 galleys. The Britons made no oppoſition to his landing; but Cæſar, getting intelligence that an army was aſſembled at no great diſtance, marched in queſt of them. He found them encamped on the banks of a river, ſuppoſed to be the *Stour*, about 12 miles diſtant from the place where he had landed. They attempted to oppoſe his paſſage; but being briſkly attacked by the Roman cavalry, they were obliged to retire into a wood, all the avenues of which were blocked up by trees cut down for that purpoſe. This fortification, however, proved inſufficient to protect them. The ſeventh legion having caſt themſelves into a teſtudo, and thrown up a mount againſt their works, drove them from their aſylum; but as the day was far ſpent, a purſuit was not thought adviſable.

England.

8 Cæſar returns.

9 Defeats the Britons.

Next morning Cæſar, with the greateſt part of his army, which he divided into three bodies, marched out in queſt of the enemy. But when he was already come in ſight of their rear, he was overtaken by meſſengers, who informed him, that his fleet was greatly damaged by a violent ſtorm which had happened the preceding night. This put an end to the purſuit for that time; but Cæſar having employed all the carpenters he had with him, and ſent for others from Gaul, in order to repair the damage, reſolved to prevent misfortunes of this kind for the future. He therefore drew all his ſhips aſhore, and encloſed them within the fortifications of his camp. This arduous undertaking employed his whole army for 10 days; after which he again ſet out in queſt of the enemy.

The Britons had made the beſt uſe they could of the reſpite afforded them by the ſtorm. They were headed by Caſſibelaunus king of the Trinobantes. He had formerly made war upon his neighbours; and having rendered himſelf terrible to them, was looked upon to be the moſt proper perſon for leading them on againſt the common enemy; and as ſeveral ſtates had now joined their forces, the Britiſh army was very numerous. Their cavalry and chariots attacked the Roman army while on their march; but were repulſed with loſs, and driven into the woods. The Romans purſued them too eagerly, and thus loſt ſome of their own men; which encouraged the Britons to make another fierce attack; but in this alſo they were finally unſucceſsful, and obliged to retire, though their loſs ſeems not to have been great.

Next day the Britons ſuddenly attacked the Roman legions as they were foraging; but meeting with a vigorous reſiſtance, they ſoon betook themſelves to flight. The Romans purſued them ſo cloſely, that having neither time to rally nor get down from their chariots according to cuſtom, great numbers of them were cut in pieces: and this overthrow had ſuch an effect upon the auxiliaries of Caſſibelaunus, that all of them abandoned him; nor did the Britons ever afterwards engage Cæſar with united forces. Cæſar, purſuing his victory, marched

England.

marched towards the Thames, with a deſign to croſs that river, and enter the territories of the Trinobantes. The river was fordable only at one place, and that not without great difficulty; but when he came to it, he found the enemy's forces drawn up in a conſiderable body on the oppoſite bank, which was fortified with ſharp ſtakes. They had likewiſe driven many ſtakes of the ſame kind into the bottom of the river, the tops of which were covered with water. Theſe ſtakes are viſible to this day as a place called *Walton* in Surry. They are made of oak; and though they have been ſo long in the water, are as hard as Brazil, and as black as jet; and have ſometimes been pulled out in order to make knife handles of them.

10 Cæſar croſſes the Thames.

11 Gives the Britons frequent overthrows.

Cæſar was not at all diſmayed at theſe difficulties, which he had intelligence of by priſoners and deſerters. He ordered the cavalry to enter firſt, and the foot to follow. His orders were obeyed, and the ſoldiers advanced with ſuch reſolution, that though the infantry were up to the chin in water, the enemy, unable to ſuſtain their aſſault, abandoned the bank and fled. After this defeat, Caſſibelaunus himſelf deſpaired of ſucceſs, and therefore diſmiſſed all his forces except about 4000 chariots, with which he obſerved the motions of the Romans, haraſſing them by cutting off ſtraggling parties, &c. This, however, was not ſufficient to keep up the ſpirits of his countrymen. On the contrary, they depoſed him from the kingdom, and choſe Mandubratius, whoſe father had been murdered by Caſſibelaunus, who thereupon uſurped the kingdom. The young prince had fled to Cæſar, who gave him protection; and the Trinobantes now offered to ſubmit to the conqueror, provided he would give them Mandubratius for their king.

Cæſar readily complied with the requeſt of the Trinobantes upon their ſending him 40 hoſtages; and the ſubmiſſion of the Trinobantes was ſoon followed by that of other ſtates and tribes; for each of the 17 nations already mentioned were compoſed of ſeveral different tribes, of which no particular account can be given. —Cæſar next marched to Verulamium, or Canterbury, which was Caſſibelaunus's capital, and which he ſtill kept poſſeſſion of; but though the place was ſtrongly fortified both by nature and art, the Britons were unable to bear the aſſault of the Romans, and therefore ſoon fled out at one of the avenues. Many were taken as they attempted to make their eſcape, and many more cut in pieces.

After this loſs, Caſſibelaunus, as his laſt reſource, found means to draw into confederacy with him four kings of the Cantii. But though Cæſar gives them the title of kings, it is probable that they were only petty princes, tributary to the king of that nation. Their names were Cingetorix, Corvilius, Taximagulus, and Segonax. Theſe, having raiſed what forces they could, attacked the camp where the ſhips were laid up: but the Romans having made a ſally, repulſed them with great ſlaughter, and then returned to their trenches without any loſs; after which, Caſſibelaunus thought proper to ſubmit to the conqueror. As the ſummer was already far ſpent, Cæſar hearkened to his propoſals. A peace was concluded on the following terms, viz. that the Britons ſhould pay an annual tribute to the Romans, that Caſſibelaunus ſhould leave Maudubratius in peaceable poſſeſſion of his dominions, that he ſhould not moleſt the Trinobantes, and that he ſhould deliver a certain number of hoſtages. Theſe terms being agreed to, Cæſar ſet ſail with his whole fleet from Britain, to which he never returned.

England.

12 He leaves the iſland altogether.

Such is the account given by Cæſar himſelf of his two expeditions into Britain; but other authors have ſpoken very doubtfully of his victories in this iſland. Dio Caſſius tells us, that the Britons utterly defeated the Roman infantry, but were at laſt put in diſorder by their cavalry. Horace and Tibullus, in many parts of their works, ſpeak of the Britons as a people not yet conquered. Tacitus ſays, that Cæſar rather ſhowed the Romans the way to Britain, than put them in poſſeſſion of it; and Lucan tells us plainly, that Cæſar turned his back to the Britons and fled. This laſt, however, conſidering the conſummate military genius of Cæſar, is by no means probable. That he left Britain, during the winter, was, in all probability, to prevent inſurrections among the Gauls, which might very readily have happened: and that he did not return to finiſh his conqueſt can be no wonder, ſeeing his ambition would certainly be more gratified by being called emperor of Rome, than conqueror of Britain.

The departure of Julius Cæſar, which happened about 53 years before Chriſt, left the Britons without any fear of a foreign enemy. We are not, therefore, to imagine, that they would regard their promiſes of paying tribute; nor was it probably demanded for a good number of years afterwards. Auguſtus, however, when he had got himſelf fully eſtabliſhed on the throne, had twice a deſign of invading Britain and forcing the inhabitants to pay the tribute promiſed to Julius Cæſar. Both times, however, he was prevented by revolts in different provinces in the empire, ſo that the Britons ſtill continued to enjoy their liberty. They thought proper, however, to court the favour of the Romans as much as they could by pretended ſubmiſſions; but, in the reign of Claudius, the Romans ſet about reducing them to ſubjection in good earneſt. The occaſion of this war is related by Dio Caſſius as follows. "Cunobelinus, the third in ſucceſſion from Caſſibelaunus, being dead, his two ſons, Togodumnus and Caractacus, ſucceeded to the throne; but whether they reigned jointly or ſeparately, is not known. In their reign one Bericus, of whom we alſo know very little, being driven out of the iſland for attempting to raiſe a ſedition, fled with ſome of his partiſans to Rome, and perſuaded Claudius to make war on his countrymen. The Britons, on the other hand, reſented the behaviour of Claudius in receiving theſe vagabonds, and therefore prohibited all intercourſe with the Romans. A much ſmaller offence than this would have been ſufficient at any time to provoke that haughty nation to declare war. An army was therefore immediately ordered into Britain, under the command of Plautius prætor in Gaul. The ſoldiers at firſt refuſed to embark, from a ſuperſtitious notion, that they were going to be ſent without the compaſs of the world; and this mutiny being related to the Britons, they did not make the neceſſary preparations for their own defence. The Roman ſoldiers were ſoon brought to a ſenſe of their duty; and ſet out from three different ports, in order to land in three different places of Britain at once.

13 Why the war with the Romans was renewed.

Being

England. Being driven back by contrary winds, their fears began to return; but they reſumed their courage on the appearance of a meteor ſhooting from the eaſt, which they imagined was ſent from heaven to direct their courſe. They landed without oppoſition; and the Britons, not having drawn together a ſufficient army, kept in ſmall bodies behind their marſhes, and in woods, in order to ſpin out the war till winter; which they thought Plautius, as Cæſar had done, would paſs in Gaul. England.

14 The Britons defeated. The Roman general marched firſt in queſt of the two kings Togodumnus and Caractacus; both of whom he found out, and defeated one after another. He then reduced part of the Dobuni, at that time ſubject to the Cattieuchlani; and leaving a garriſon to keep them in awe, he advancéd to a river where the Britons lay careleſsly encamped, ſuppoſing that the Romans could not paſs it without a bridge. But the Germans in the Roman army had been accuſtomed to ſwim acroſs the ſtrongeſt currents with their heavy armour. They therefore paſſed the river firſt; and having, according to their orders, fallen only upon the enemy's horſes which drew their chariots, theſe formidable machines were rendered entirely uſeleſs; and the Britons were put to flight as ſoon as another part of the forces could paſs the river.

The Britons were not diſheartened with this defeat, but engaged the Romans next day with great bravery. Victory continued long doubtful; but at length the Romans prevailed, and the Britons were forced to betake themſelves to flight. This battle is thought to have been fought on the banks of the Severn. From thence the Britons fled to the mouth of the Thames. They were cloſely purſued by the Romans; but the latter being unacquainted with the flats and ſhallows of the river, were often in great danger. The Germans, however, croſſed by ſwimming as before, and the reſt on a bridge ſomewhat farther up the river; ſo that the Britons were in a ſhort time ſurrounded on all ſides, and great numbers of them cut in pieces. Many of the Romans, alſo, purſuing the fugitives with too great eagerneſs, were loſt in the marſhes.—In one of theſe battles Togodumnus was killed; but the Britons were ſo far from being diſheartened, that they ſhowed more eagerneſs than ever to oppoſe the Romans, in order to revenge his death. Plautius, therefore, did not think proper to penetrate farther into the country, but contented himſelf with putting garriſons in the places he had already conquered. He then wrote to the emperor himſelf; who no ſooner received an account of his ſucceſs, than he ſet out for Britain; where, having landed after a ſhort voyage, he joined Plautius on the banks of the Thames.

15 Claudius arrives in Britain.

Soon after the arrival of Claudius, the Romans paſſed the Thames, attacked the Britiſh army, and totally defeated it. The conſequence of this was the taking of Cunobelinus's capital, and the ſubmiſſion of ſeveral of the neighbouring ſtates. The emperor, however, did not make a long ſtay in the iſland, but left Plautius to purſue his conqueſts. This he did with ſuch ſucceſs, that, on his return to Rome, he was met without the gates by the emperor himſelf, who, at his ſolemn entry, gave him the right hand.—The Britons ſeem to have made a very obſtinate reſiſtance to the Roman arms about this time. Veſpaſian, who was afterwards emperor, is ſaid to have fought 30 battles with them; and the exploits of Titus his ſon are alſo much celebrated by the Roman hiſtorians. England.

In the ninth year of Claudius, P. Oſtorius Scapula was ſent into Britain. By far the greater part of the 17 nations formerly mentioned were at this time unconquered. Some of theſe had broken into the Roman territories; but Oſtorius falling unexpectedly upon them, put great numbers to the ſword, and diſperſed the reſt. To prevent them for the future from making inroads into the territories of the Romans or their allies, he built ſeveral forts on the Severn, the Avon, and the Nen, reducing the country ſouth of theſe rivers to a Roman province. This ſo highly offended the Iceni, that, being joined by the neighbouring nations, they raiſed a conſiderable army, and encamped in an advantageous ſituation, in order to prevent the Romans from penetrating farther into the iſland. Oſtorius, however, ſoon advanced againſt them. The Romans, as uſual, got the victory, and the enemy were purſued with great ſlaughter. The Roman general then, having quelled an inſurrection among the Brigantes, led his army againſt the Silures. They were headed by their king Caractacus, a moſt renowned warrior. He ſhowed his military talents by chooſing a very advantageous place for engaging the enemy. Tacitus tells us, "it was on the ridge of an exceeding ſteep mountain; and where the ſides of it were inclining and acceſſible, he reared walls of ſtone for a rampart. At the foot of the mountain flowed a river dangerous to be forded, and an army of men guarded his entrenchments." This hill is thought to be one called *Caer-Caradoc* in Shropſhire, ſituated near the conflux of the rivers Colun and Teme, and where the remains of ancient entrenchments are ſtill viſible.—On the approach of the enemy, Caractacus drew up his troops in order of battle, animating them with the following ſpeech, according to Tacitus. "That from this day, and this battle, they muſt date their liberty reſcued, or their ſlavery for ever eſtabliſhed. He then invoked the ſhades of thoſe heroes who had expelled Cæſar the dictator; thoſe brave men by whoſe valour they ſtill enjoyed freedom from Roman tribute and taxes, and by which their wives and children were as yet preſerved from proſtitution." The whole army then took a ſolemn oath either to conquer or die, and prepared for the charge with the moſt terrible ſhouts. Oſtorius was ſomewhat diſmayed when he conſidered the uncommon fierceneſs of the enemy, and the other difficulties which he had to encounter. He led on his men, however, to the charge; and the Romans were attended with their uſual good fortune. The Britons were put to flight. Vaſt numbers fell on the field of battle and in the purſuit, and many more were taken priſoners. Among the latter were the wife, the daughter, and the brothers, of Caractacus. The unfortunate prince himſelf fled to Cartiſmundua queen of the Brigantes, by whom he was delivered up to the Roman general, who ſent him in chains to Rome. Caractacus bore his misfortunes with magnanimity; and when he came before the emperor, addreſſed him in the following terms. "If my moderation in proſperity, O Claudius! had been as conſpicuous as my birth and fortune, I ſhould now have entered this city as a friend, and not as priſoner; nor would you have diſdained the

16 Caractacus defeated and taken priſoner.

17 His ſpeech to the Roman emperor.

England. the friendſhip of a prince deſcended from ſuch illuſtrious anceſtors, and governing ſo many nations. My preſent condition, I own, is to you honourable, to me humiliating. I was lately poſſeſſed of ſubjects, horſes, arms, and riches. Can you be ſurpriſed that I endeavoured to preſerve them? If you Romans have a deſire to arrive at univerſal monarchy, muſt all nations, to gratify you, tamely ſubmit to ſervitude? If I had ſubmitted without a ſtruggle, how much would it have diminiſhed the luſtre of my fall, and of your victory? And now, if you reſolve to put me to death, my ſtory will ſoon be buried in oblivion; but if you think proper to preſerve my life, I ſhall remain a laſting monument of your clemency."—This ſpeech had ſuch an effect upon Claudius, that he immediately pardoned Caractacus and his whole family, and commanded them to be ſet at liberty.

The Silures, notwithſtanding this terrible blow, continued the war with great vigour, and gained conſiderable advantages over the Romans; which ſo much affected Oſtorius, that he died of grief. He was ſucceeded by A. Didius, who reſtrained the incurſions of the Silures, but was not able to reſtore Cartiſmundua queen of the Brigantes, who had been depoſed by her ſubjects. Didius was ſucceeded by Veranius, and he by Suetonius Paulinus, who reduced the iſland of ANGLESEY, as related under that article. But while Paulinus was employed in the conqueſt of this iſland, he was alarmed by the news of an almoſt univerſal revolt among thoſe nations which had ſubmitted to the Romans. The Britons, though conquered, had ſtill a deſire of returning to their former ſtate of independence; and the Roman yoke became every day more unſupportable to them, through the inſolence and oppreſſions of the Roman ſoldiers. The Britons had been long diſcontented, and were already in a very proper diſpoſition for a revolt, when an event happened which kindled theſe diſcontents into an open flame. Praſutagus king of the Iceni, a prince renowned for opulence and grandeur, had, by his laſt will, left the Roman emperor, joint-heir with his two daughters, in hopes of obtaining his favour and protection by ſo great an obligation. But the event turned out very different. No ſooner was he dead, than his houſes and poſſeſſions were all plundered by the Roman ſoldiers. The queen Boadicea remonſtrated againſt this injuſtice; but, inſtead of obtaining any redreſs, ſhe herſelf was publicly whipped, her daughters raviſhed, and all the relations of the late king reduced to ſlavery. The whole country alſo was plundered, and all the chiefs of the Iceni deprived of their poſſeſſions.

18 General revolt of the Britons.

Boadicea was a woman of too haughty a ſpirit tamely to bear ſuch indignities. She therefore perſuaded the Iceni to take up arms, which they very readily did. Then, being joined by the Trinobantes, and ſome other nations, they poured like a torrent on the Roman colonies. Every thing was deſtroyed with fire and ſword. The ninth legion, which had been left for the defence of the country under Petilius Cerealis, was defeated, the infantry totally cut in pieces, and the commander himſelf with the cavalry eſcaped with the utmoſt difficulty. Suetonius, alarmed at this news, immediately left Angleſey, and marched with the greateſt expedition to London. The inhabitants were overjoyed at his arrival, and uſed their utmoſt endeavours to detain him for their defence. But he refuſed to ſtay, and in a ſhort time left the place, notwithſtanding the intreaties of the inhabitants. The whole city lamented his departure; and they had reaſon. Suetonius was ſcarce gone, when Boadicea with her Britons entered, and put all they found in it to the ſword. None were taken priſoners, nor was any ſex or age ſpared, and many were tortured in the moſt cruel manner. Seventy thouſand perſons are ſaid to have periſhed on this occaſion at London and other Roman colonies.

England. 19 They deſtroy 70,000 Romans.

The Britons, now elated with ſucceſs, aſſembled from all quarters in great numbers, ſo that Boadicea's army ſoon amounted to 230,000 men. They deſpiſed the Romans; and became ſo confident of victory, that they brought their wives and children along with them in waggons to be ſpectators of the deſtruction of their enemies. The event was what might naturally have been expected from ſuch ill-judged confidence. The Britons were overthrown with moſt terrible ſlaughter, no fewer than 80,000 being killed in the battle and purſuit; while the Romans had not above 400 killed, and not many more wounded. Boadicea, not able to ſurvive ſo great a calamity, put an end to her life by poiſon.

20 They are totally defeated.

By this overthrow the Britons, who had once been ſubdued, were thoroughly prevented from raiſing any more inſurrections, and even thoſe who had not yet ſubmitted to the Roman yoke ſeemed to be intimidated from making incurſions into their dominions. Nothing remarkable therefore happened for ſome time. In the time of Veſpaſian, Petilius Cerealis being appointed governor of Britain, attacked the Brigantes, defeated them in ſeveral battles, and reduced great part of their country. He was ſucceeded by Julius Frontinus; who not only maintained the conqueſts of his predeceſſor, but reduced entirely the warlike nation of the Silures. Frontinus was ſucceeded by the celebrated Cneius Julius Agricola, who completed the conqueſt of all the ſouthern Britons.

Juſt before the arrival of Agricola, the Ordovices had cut in pieces a band of horſe ſtationed on their confines, after which the whole nation had taken arms. The ſummer was pretty far ſpent, and the Roman army was quite ſeparated and diſperſed, the ſoldiers having aſſured themſelves of reſt for the remaining part of the year. Agricola, however, was no ſooner landed, than, having drawn together his legions, he marched againſt the enemy without delay. The Britons kept upon the ridges of the mountains; but Agricola led them in perſon up the aſcents. The Romans were victorious; and ſuch a terrible ſlaughter was made of the Britons, that almoſt the whole nation of Ordovices was cut off. Without giving the enemy time to recover from the terror which this overthrow had occaſioned, Agricola reſolved upon the immediate reduction of Angleſey, which had been loſt by the revolt of Boadicea. Being deſtitute of ſhips, he detached a choſen body of auxiliaries who knew the fords, and were accuſtomed to manage their arms and horſes in the water. The Britons, who had expected a fleet and tranſports, were ſo terrified by the appearance of the Roman forces on their iſland, that they immediately ſubmitted, and Angleſey was once more reſtored to the Romans.

21 Britain conquered by Agricola.

With the conqueſt of Angleſey ended the firſt campaign

England. paign of Agricola; and he employed the winter in reconciling the Britons to the Roman yoke. In this he met with ſuch ſucceſs, through his wiſe and equitable conduct, that the Britons, barbarous as they were, began to prefer a life of ſecurity and peace, to that independency which they had formerly enjoyed, and which continually expoſed them to the tumults and calamities of war. The ſucceeding campaigns of Agricola were attended with equal ſucceſs; he not only ſubdued the 17 nations inhabiting England, but carried the Roman arms almoſt to the extremity of Scotland. He alſo cauſed his fleet to ſail round the iſland, and diſcovered the Orcades, or Orkney iſlands, which had before been unknown to the reſt of the world. His expedition took him up about ſix years, and was completed in the year of Chriſt 84.

Had this commander been continued in Britain, it is probable that both Scotland and England would have been permanently ſubdued; but he was recalled by Domitian in the year 85, and we are then almoſt totally in the dark about the Britiſh affairs till the reign of the emperor Adrian. During this interval the Caledonians had taken arms, and not only refuſed ſubjection to the Roman power themſelves, but ravaged the territories of the Britons who continued faithful to them. Adrian, for what reaſon is not well known, abandoned to them the whole tract lying between the Tyne and the Forth. At the ſame time, in order to reſtrain them from making incurſions into the Roman territories, he built a wall 80 miles in length from the river Eden in Cumberland to the Tyne in Northumberland *. He was ſucceeded by Antoninus Pius, in whoſe reign the Brigantes revolted; and the Caledonians, having in ſeveral places broken down the wall built by Adrian, began anew to ravage the Roman territories. Againſt them the emperor ſent Lollius Urbicus, who reduced the Brigantes; and having defeated the northern nations, confined them within narrower bounds by a new wall †, extending probably between the friths of Forth and Clyde. From the time of Antoninus to that of Severus, the Roman dominions in Britain continued to be much infeſted by the inroads of the northern nations. That emperor divided Britain into two governments, the ſouthern and northern; but the governor of the northern diviſion was ſo haraſſed by continual incurſions of the Caledonians, that he was at length obliged to purchaſe a peace with money. The Caledonians kept the treaty for 15 years; after which, breaking into the Roman territories anew, they committed terrible ravages. Virius Lupus the governor, not being in a condition to withſtand them, acquainted the emperor with his diſtreſs, intreating him to ſend powerful and ſpeedy ſupplies. Upon this Severus reſolved to put an end to the perpetual incurſions of the enemy, by making a complete conqueſt of their country; for which purpoſe he ſet out for Britain, together with his two ſons Caracalla and Geta, at the head of a numerous army. The Caledonians no ſooner heard of his arrival, than they ſent ambaſſadors offering to conclude a peace upon honourable terms. But theſe the emperor detained till he was ready to take the field, and then diſmiſſed them without granting their requeſt.

As ſoon as the ſeaſon was fit for action, Severus marched into the territories of the Caledonians, where he put all to fire and ſword. He advanced even to the moſt northerly parts of the iſland; and though no battle was fought in this expedition, yet through the continual ambuſcades of the enemy, and the inhoſpitable nature of the country, he is ſaid to have loſt 50,000 men. At laſt the Caledonians were obliged to ſue for peace; which was granted them on condition of their yielding part of their country, and delivering up their arms. After this the emperor returned to York, leaving his ſon Caracalla to command the army, and finiſh the new wall which had been begun between the friths of Forth and Clyde. But the emperor being taken ill at York, the Caledonians no ſooner heard of his indiſpoſition, than they again took up arms. This provoked Severus to ſuch a degree, that he commanded his ſon Caracalla to enter their country anew with the whole army, and to put all he met to the ſword without diſtinction of ſex or age. Before theſe orders, however, could be put in execution, his two ſons, having concluded a ſhameful peace with the Caledonians, returned to Rome. England.

A long chaſm now takes place in the hiſtory of the Roman dominions in Britain. In the beginning of Diocleſian's reign, Carauſius a native of Gaul, paſſing over into Britain, took upon him the title of *emperor*, and was acknowledged by all the troops quartered here. He was, however, killed in a battle with one of Conſtantius's officers, after he had enjoyed the ſovereignty for ſix or ſeven years. Conſtantine the Great began his reign in this iſland; and returned ſoon after he had left it, probably with a deſign to put a ſtop to the daily incurſions of the Caledonians. He altered the diviſion of that part of Britain ſubject to the Romans. Severus had divided it only into two provinces; but Conſtantine increaſed the number to three, viz. Britannia Prima, Britannia Secunda, and Maxima Cæſarienſis; and this laſt was afterwards divided into two, viz. Maxima Cæſarienſis and Flavia Cæſarienſis. The removal of the imperial ſeat from Rome to Conſtantinople, which happened in the reign of Conſtantine, gave the northern nations an opportunity of making frequent incurſions into the Roman provinces; the emperor having carried with him, firſt into Gaul, and then into the Eaſt, not only moſt of the Roman troops, but likewiſe the flower of the Britiſh youth.

About the latter end of the reign of Conſtantius ſon to Conſtantine the Great, the government of the province of Britain, and other weſtern parts of the empire, was committed to Julian, afterwards called the *apoſtate*. While he was in his winter quarters at Paris, he was informed that the Scots and Picts, about this time firſt diſtinguiſhed by theſe names, had broken into the Roman territories and committed everywhere dreadful ravages. Againſt them Julian diſpatched a body of troops under the command of Lupicinius. He embarked from Boulogne in the depth of winter, but was no ſooner arrived at London than he was recalled; the enemy having probably found means to appeaſe Julian by their ſubmiſſions. Till the reign of Valentinian I. theſe nations ſtill continued to infeſt the Roman territories in Britain, and had now reduced the country to a moſt deplorable condition by their continual ravages. Valentinian ſent againſt them Theodoſius, father to the emperor of that name. That gene-

ral

* See *Adrian.*

† See *Antoninus's* wall.

22 Expedition of Severus into Britain.

England. ral having divided his forces into ſeveral bodies, advanced againſt the enemy, who were roving up and down the country. The Scots and Picts were obliged to yield to the ſuperior valour and diſcipline of the Romans. Great numbers were cut in pieces; they were forced to abandon all the booty and priſoners they had taken, and to retire beyond the friths of Forth and Clyde. Theodoſius then entered London in triumph, and reſtored that city to its former ſplendor, which had ſuffered greatly by the former incurſions of the northern Britons. To reſtrain them from breaking anew into the provinces, Theodoſius built ſeveral forts or caſtles between the two friths; and having thus recovered all the country between Adrian's wall and the friths of Forth and Clyde, he formed of it a fifth province, which he called *Valentia*.

Though Britain was now reduced to a ſtate of temporary tranquillity, yet as the Roman empire was daily declining, it is not to be ſuppoſed that ſufficient care could be taken to ſecure ſuch a diſtant province. In the reign of the emperor Honorius, the provincial Britons found themſelves annoyed not only by the Scots and Picts, but alſo by the depredations of the Saxons, who began to commit ravages on the ſea-coaſts. By the care, however, of Stilicho, prime miniſter to Honorius, matters were once more ſettled, and a particular officer was appointed to guard the coaſt againſt the attempts of the Saxons, with the title of *Comes litoris Saxonici*. But, not long after, the empire being overrun by barbarians, moſt of the Roman troops quartered in Britain were recalled, and the country left quite open to the attacks of the Scots and Picts.

23 The Britons chooſe an emperor of their own.

Upon this the provincials expecting no more aſſiſtance from Honorius, reſolved to ſet up an emperor of their own. Accordingly they inveſted with the imperial dignity one *Mark*, an officer of great credit among them. Him they murdered in a few days, and placed on the throne one Gratian a native of Britain. After a reign of four months, Gratian underwent the fate of his predeceſſor; and was ſucceeded by *Conſtantine*, a common ſoldier, who was choſen merely for the ſake of his name. He ſeems, however, to have been a man of ſome knowledge and experience in war. He drove the Scots and Picts beyond the limits of the Roman territories; but being elated with this ſucceſs, he would now be ſatisfied with nothing leſs than the conqueſt of the whole Roman empire. He therefore paſſed over into Gaul; and took with him not only the few Roman forces that had been left, but ſuch of the provincial Britons as were moſt accuſtomed to arms. That unhappy people, being now left entirely defenceleſs, were haraſſed in the moſt cruel manner by their enemies; who broke into the country, and deſtroyed all with fire and ſword. In this miſerable ſituation they continued from the year 407, when the uſurper Conſtantine paſſed over into Gaul, till the year 410. Having during the laſt three years frequently implored aſſiſtance from Rome without receiving any, they now reſolved to withdraw their allegiance from an empire which was no longer able to protect them. Honorius himſelf applauded their conduct; and adviſed them by letters to provide for their own ſafety, which was in effect an implicit reſignation of the ſovereignty of the iſland.

The provincial Britons now regained their liberty; but they had loſt the martial ſpirit which had at firſt rendered them ſo formidable to the Romans. They ſeem, however, to have met with ſome ſucceſs in their firſt enterpriſes; for Zoſimus tells us, that they delivered their cities from the inſults of an haughty enemy. But being at laſt overpowered, they were again obliged to have recourſe to the Roman emperor, to whom they promiſed a moſt perfect ſubmiſſion, provided they were delivered from the hands of their mercileſs and implacable enemies. Honorius, touched with compaſſion, ſent a legion to their relief. The Roman forces landed in Britain unexpectedly; and having deſtroyed great numbers of the Scots and Picts, they drove them beyond the friths of Forth and Dunbritton. After this they adviſed the natives to build a wall on the iſthmus from ſea to ſea, and to reaſſume their courage, and defend themſelves from their enemies by their own valour. The Romans then quitted the country; being obliged to return, in order to repulſe thoſe barbarians who had broken into the empire from all quarters.

England. 24 Implore the aſſiſtance of the Romans.

The Britons immediately ſet about building the wall, as they had been deſired, with great alacrity. But as it was conſtructed only of turf, the Scots and Picts ſoon broke it down in ſeveral places; and, pouring in upon the defenceleſs and effeminate provincials, committed more cruel ravages than ever. At laſt, after very many and grievous calamities, the latter ſent ambaſſadors once more to Rome. Theſe appeared with their garments rent and duſt on their heads; and at laſt prevailed on the emperor, by their earneſt intreaties, to ſend another legion to their relief. The troops arrived in Britain before the enemy had the leaſt knowledge of their having ſet ſail. They were therefore quite unprepared for an attack, and roving up and down the country in the utmoſt diſorder. The Romans made a terrible havock among them, and drove the remainder into their own country. As Honorius had ſent them not with any ambitious view of retaining the iſland in ſubjection, but merely out of compaſſion to the unhappy provincials, the Romans told them, they had now no farther aſſiſtance to expect from them. They informed them, that the legion muſt immediately return to the continent, to protect the empire from the barbarians, who had extended their ravages almoſt to every part of it; and therefore, that they muſt now take their laſt farewel of Britain, and totally abandon the iſland. After this declaration Gallio, the commander of the Roman troops, exhorted the provincials to defend themſelves, by fighting bravely for their country, wives, and children, and what ought to be dearer than life itſelf, their liberty; telling them, at the ſame time, that their enemies were no ſtronger than themſelves, provided they would but lay aſide their fears, and exert their ancient courage and reſolution. That they might the better withſtand the attacks of the enemy, he adviſed them to build a wall, not of turf, but of ſtone; offering to aſſiſt them with his ſoldiers, and to direct them himſelf in the execution. Upon this the Britons immediately fell to work; and with the aſſiſtance of the Romans, finiſhed it in a ſhort time, though it was no leſs than eight feet thick, and twelve feet in height. It is thought to have been built on the ſame place where Severus's wall formerly ſtood. Towers were alſo built at con-

25 Send ambaſſadors a ſecond time to Rome.

England.

venient diſtances on the eaſt coaſt, to prevent the deſcents of the Saxons and other barbarians that came from Germany. Gallio employed the reſt of his time in teaching the provincials the art of war. He left them patterns of the Roman weapons, which he alſo taught them to make; and after many encouraging exhortations, he took his laſt farewel of Britain, to which the Romans never returned. There is a great diſagreement among chronologers as to the year in which the Romans finally abandoned Britain; ſome placing it in 422; others in 423, or 426; and ſome in 431, 435, or 437.

26 Britain finally abandoned by the Romans.

The final departure of the Romans was no ſooner known to the Scots and Picts, than they poured in upon the provincial Britons from all quarters, like hungry wolves breaking into a ſheep-fold. When the Scots approached the new built-wall, they found it completely finiſhed, and guarded by great numbers of armed men. But ſo little had the provincial Britons profited by the military inſtructions of the Romans, that inſtead of placing proper guards and centinels, and relieving one another by turns, their whole number had ſtaid ſeveral days and nights upon the ramparts without intermiſſion. Being therefore quite benumbed and wearied out, they were able to make but very little reſiſtance. Many were pulled down with hooks from the battlements, and daſhed in pieces. The reſt were driven from their ſtations with ſhowers of darts and arrows. They betook themſelves to flight; but that could not ſave them. The Scots and Picts purſued them cloſe, made a dreadful havock among the fugitives, and took poſſeſſion of the frontier towns, which they found deſerted by the inhabitants. As they now met with no more oppoſition, they overran the whole country, putting every thing to fire and ſword. Their ravages ſoon occaſioned a famine; and this was followed by a kind of civil war. The provincials, unable to ſupport themſelves, were obliged to plunder each other of the little the common enemy had left them. The whole country at laſt became ſo incapable of ſupporting thoſe who were left in it, that many fled into the woods, in order to ſubſiſt themſelves there by hunting.

27 Britons miſerably haraſſed by the Scots and Picts.

28 Implore the aſſiſtance of the Romans.

In this extremity of diſtreſs they had once more recourſe to the Romans; and wrote in the moſt mournful ſtyle that can poſſibly be imagined to Aetius, who was then conſul the third time. Their letter they directed thus: "The groans of the Britons to the conſul Aetius." The contents of this letter were anſwerable to the direction. "The barbarians (ſay they) drive us to the ſea; the ſea drives us back to the barbarians; between which we have only the choice of two deaths, either to be ſwallowed up by the waves, or to be cruelly maſſacred by the enemy."

To this letter the Roman general gave no ſatisfactory anſwer, and the provincials were thereupon reduced to deſpair. Great numbers of them fled over to Armorica, where they ſettled along with others who had formerly gone over with an uſurper called *Maximus*; while others ſubmitted to the Scots and Picts. Some, however, more reſolute than the reſt, had once more recourſe to arms. They ſallied out in parties from the woods and caves where they had been obliged to hide themſelves, and, falling unexpectedly on the enemy, cut great numbers of them in pieces, and obliged the reſt to retire. Having thus obtained ſome reſpite, they began again to cultivate their lands; which, having lain fallow for a long time, now produced all ſorts of corn in the greateſt plenty. This plenty, according to the hiſtorian Gildas, occaſioned the moſt conſummate wickedneſs and corruption of manners among all ranks of men. The clergy, ſays he, who ſhould have reclaimed the laity by their example, proved the ringleaders in every vice; being addicted to drunkenneſs, contention, envy, &c.—It is poſſible, however, that this deſcription might be exaggerated by Gildas, who was himſelf a monk. But however this was, the Britons had not long enjoyed peace, when they were alarmed by a report, that the Scots and Picts were about to return with a far greater force than before, utterly to extirpate the name of their ſouthern neighbours, and ſeize upon the country for themſelves. This report threw them into a terrible conſternation; and to add to the reſt of their misfortunes, they were now viſited by a dreadful plague, which raged with ſuch violence, that the living were ſcarce ſufficient to bury the dead. The contagion no ſooner ceaſed, than they found their country invaded by the Scots and Picts, who deſtroyed every thing with fire and ſword; ſo that the provincials were ſoon reduced to the ſame miſerable ſtate they had formerly been in.

29 They at laſt repulſe their enemies.

30 Are again threatened with an invaſion.

At this time the chief, if not the only, king of the ſouthern diviſion of Britain, was one *Vortigern*. He is ſaid to have been a cruel, debauched tyrant, regardleſs of the public welfare, and totally incapable of promoting it. Being now rouſed from his inſenſibility, however, by a ſenſe of his own danger, he ſummoned a council of the chief men of the nation, in order to deliberate about the proper means for delivering the country from thoſe calamities under which it groaned. In this council the moſt pernicious meaſure was adopted that could poſſibly have been reſolved on; namely, to invite to their aſſiſtance the *Saxons*, a people famous for their piracies and cruelty, and juſtly dreaded by the Britons themſelves *. This fatal expedient being agreed upon, ambaſſadors were immediately diſpatched into Germany with advantagous propoſals to the Saxons in caſe they would come over to their aſſiſtance.

31 They reſolve to call in the Saxons.

* See *Saxons*.

The Britiſh ambaſſadors ſoon arrived in Germany, and, according to Witichind, a Saxon hiſtorian of the ninth century, made the following ſpeech before an aſſembly of the Saxons.—"Illuſtrious Saxons, the fame of your victories having reached our ears, the diſtreſſed Britons, haraſſed by the continual inroads of a neighbouring enemy, ſend us to implore your aſſiſtance. We have a fertile and ſpacious country, which we are commanded to ſubmit to you. We have hitherto lived under the protection of the Roman empire; but our ancient maſters having abandoned us, we know no nation more powerful than you, and better able to protect us. We therefore recur to your valour. Forſake us not in our diſtreſs, and we ſhall readily ſubmit to what terms you yourſelves ſhall think fit to preſcribe to us."—If this abject and ſhameful ſpeech was really made, it muſt give us a very ſtrange idea of the national ſpirit of the provincial Britons at that time. It is, however probable that the whole is a fiction, deſigned only to excuſe the perfidious treatment which theſe Britons afterwards received from the Saxons.

England. Saxons. The moſt reſpectable even of the Saxon hiſtorians make no mention of ſuch a ſpeech; and it is certain, that when the Saxons themſelves wanted to quarrel with the Britons, they never inſiſted upon the promiſe made by the Britiſh ambaſſadors; which they moſt certainly would have done, had any ſuch promiſe ever been made.

The Britiſh ambaſſadors were very favourably received by the Saxons. The latter embraced their propoſal with joy; and the rather, becauſe their ſoothſayers foretold that they ſhould plunder their Britiſh allies for 150 years, and reign over them for twice that time. Three long ſhips, in the Saxon language called *chiules*, were therefore fitted out, under the conduct of Hengiſt and Horſa. Theſe were two brothers much celebrated both for their valour and nobility. They were ſons of Witigiſil, ſaid to be great-grandſon to the Saxon god Woden; a circumſtance which added much to their authority. Having embarked about 1600 men on board their three veſſels, the two brothers arrived in the iſle of Thanet, in the year 449 or 450.

32 The Saxons arrive in Britain, and defeat the Scots and Picts.

They were received by the inhabitants with the greateſt demonſtrations of joy: the iſle in which they had landed was immediately appointed for their habitation; and a league was concluded, in virtue of which the Saxons were to defend the provincial Britons againſt all foreign enemies; and the provincials were to allow the Saxons pay and maintenance, beſides the place allotted them for their abode. Soon after their arrival, King Vortigern led them againſt the northern nations, who had lately broke into the kingdom, and advanced as far as Stanford in the county of Lincolnſhire. Here a battle was fought, in which the Scots and Picts were utterly defeated, and obliged to relinquiſh their booty.

Vortigern was ſo highly pleaſed with the behaviour of his new allies, that he beſtowed large poſſeſſions in the country they had newly delivered, upon the two commanders Hengiſt and Horſa. It is ſaid, that, even at this time, Hengiſt was taken with the wealth and fertility of the country; and at the ſame time obſerving the inhabitants to be quite enervated with luxury, began to entertain hopes of conquering part of it. He therefore, with Vortigern's conſent, invited over ſome more of his countrymen; giving them notice at the ſame time of the fruitfulneſs of the country, the effeminacy of the inhabitants, and how eaſily a conqueſt might be effected.

33 New ſupplies of Saxons arrive.

The Saxons readily complied with the invitation; and, in 452, as many more arrived in 17 veſſels, as, with thoſe already in Britain, made up an army of 5000 men. Along with theſe, according to Nennius, came over Rowena the daughter of Hengiſt. Vortigern fell in love with this lady; and in order to obtain her in marriage, divorced his lawful wife. Hengiſt pretended to be averſe to the match; but Vortigern obtained his conſent by inveſting him with the ſovereignty of Kent. The Saxon hiſtorians, indeed, make no mention of Rowena; but rather inſinuate, that their countrymen made themſelves maſters of Kent by force of arms. It ſeems moſt probable, however, that Vortigern had as yet continued in friendſhip with the Saxons, and even put more confidence in them than in his own ſubjects. For, not long after the arrival of this firſt reinforcement, Hengiſt obtained leave to ſend for a ſecond, in order, as was pretended, to defend England. the king from the attempts of his rebellious ſubjects, as well as of the Scots and Picts. Theſe embarked in 40 ſhips, under the command of Octa and Ebuſa, the ſon and nephew, or, according to ſome, the brother and nephew of Hengiſt. They landed at the Orkney iſlands; and having ravaged them, as well as all the northern coaſts of Scotland, they conquered ſeveral places beyond the Frith, and at laſt obtained leave to ſettle in Northumberland.

The pretence made for this ſettlement was, that the Saxons under Octa and Ebuſa might defend the northern frontiers of the kingdom, as thoſe under Hengiſt and Horſa did the ſouthern parts. Many more Saxons were, under various pretences, invited over; till at laſt the countries from which they came were in a manner depopulated. And now their numbers being greatly increaſed, the Saxons began to quarrel with the natives. They demanded larger allowances of corn, and other proviſions; threatening to lay waſte the whole country if their demands were not complied with. The Britons, inſtead of complying with theſe demands, deſired them to return home, ſince their numbers exceeded what they were able to maintain. Upon this, the Saxons concluded a peace with the Scots and Picts; and, turning their arms againſt the unhappy provincials, overran the whole country. The Saxons committed everywhere the greateſt cruelties. All buildings, whether public or private, they levelled with the ground. The cities were pillaged and burnt; and the people maſſacred without diſtinction of ſex or age, and that in ſuch numbers, that the living ſcarce ſufficed to bury the dead. Some of thoſe who eſcaped the general ſlaughter, took refuge among inacceſſible rocks and mountains; but there great numbers periſhed with hunger, or were forced to ſurrender themſelves as ſlaves to their enemies. Some croſſed the ſea and ſettled either in Holland or in Armorica, now the province of Britanny in France.

34 They quarrel with the Britons.

Vortigern, we are told by Nennius, was ſo far from being reclaimed by theſe calamities, that he added inceſt to his other crimes, and married his own daughter. At laſt, his own ſubjects, provoked at his enormous wickedneſs, and the partiality he ſhowed to the Saxons, depoſed him, and raiſed his ſon Vortimer to the throne. He was a young man of great valour, and willingly undertook the defence of his diſtreſſed country. He firſt fell upon the Saxons with what troops he could aſſemble, and drove them into the iſle of Thanet. Here they were beſieged, till, being reinforced by freſh ſupplies from Germany, they opened themſelves a way through the Britiſh troops. Vortimer, however, was not yet diſheartened. He engaged the Saxons on the banks of the Derwent in Kent, where he obtained a complete victory, and cut in pieces great numbers of the enemy. Another battle was fought at Aylesford in Kent. Some aſcribe the victory at this time to the Saxons, and ſome to the Britons. It is certain, however, that Horſa the brother of Hengiſt was killed in this engagement. He is ſaid to have been buried at a place in the neighbourhood, which from him obtained the name of *Horſted*.—A third battle was fought, in which the victory was uncertain, as is alſo the place where it happened. The fourth battle, however, according to Nennius proved

35 They are defeated and driven out by Vortimer.

deciſive

England. decisive in favour of the Britons. Vortimer engaged his enemies, according to some, at Folkstone; according to others, at a place called *Stonar*, in the isle of Thanet. The Saxons were defeated with great slaughter, and driven back to their ships. So complete is the victory said to have been, that the Saxons quitted the island, without making any attempt upon it for five years afterwards. These battles, however, rest entirely upon the credit of Nennius, and the historians who have followed him. They are taken notice of neither by Gildas nor Bede. The former only acquaints us, that the Saxons retired. This, by most historians, is understood of their returning home; though it is possible he might mean no more, than that, after they had laid waste the country, they retired into the territories allotted them by Vortigern, in Kent and Northumberland.

Vortimer is said to have died after a reign of six years. On his death-bed, he desired his servants to bury him near the place where the Saxons used to land; being persuaded, that the virtue of his bones would effectually prevent them from ever touching the British shore. This command, however, was neglected; and Vortimer was buried at Lincoln, according to some, or London, according to others. Hengist was no sooner informed of his death, than he invaded Britain anew with a numerous body of Saxons. He was opposed by Vortigern, who had been restored to the throne after the death of his son Vortimer. Several battles were fought on this occasion; but at last the provincials being overthrown at a place called *Crecanford*, with the loss of 4000 men, were obliged to abandon Kent to their enemies, and retire to London. This happened about the year 458 or 459; and from this time most historians date the erection of the first Saxon kingdom in Britain, viz. that of Kent. Hengist assumed the title of *king*, and chose Esk his son for his colleague.

36 They return and defeat the Britons, and erect a kingdom in Kent.

The Britons under Vortigern still continued the war. Hengist finding himself unable to gain a decisive advantage over them in the field, had recourse to treachery. He pretended to be desirous of concluding a peace with the British monarch, and of renewing his ancient friendship with him; and therefore required an interview. To this Vortigern readily consented, and accepted of an entertainment prepared for him by Hengist. The king was attended by 300 nobility all unarmed; but the Saxons had concealed daggers below their garments. The British nobility were all treacherously massacred in the height of their mirth; Vortigern himself was taken and put in fetters; nor could his liberty be procured, but by ceding to the Saxons those provinces now called *Essex*, *Sussex*, and *Middlesex*. Thus the Saxons got such a footing in Britain, that they could never afterwards be expelled. Vortigern, after being set at liberty, is said to have retired to a vast wilderness near the fall of the Wye in Radnorshire, where he was some time after consumed by lightning, together with a city called *Kaer Gourtigern* which he had built in that place.

37 Treachery of the Saxons.

On the retreat of Vortigern, the command of the British forces devolved upon Aurelius Ambrosius, or as Gildas calls him, Ambrosius Aurelianus. He was a Roman, and perhaps the last that remained in the island. He is said to have gained several victories over the Saxons. Notwithstanding this, however, they still continued to gain ground; and in the year 491, the foundation of a second Saxon kingdom was laid in Britain. This at first comprehended only the county of Sussex, but soon after extended over most of the counties lying south of the Humber. It was called the *kingdom of the South Saxons*. England.

38 Second Saxon kingdom.

The German nations being now informed of the good success which had attended the Saxons in Britain, new adventurers daily flocked over to share the good fortune of the others. They were chiefly composed of three nations, the Saxons, Angles, and Jutes. All these passed under the common appellation sometimes of *Saxons*, sometimes of *Angles*. They spoke the same language, and agreed very much in their customs and institutions, so that all of them were naturally led to combine against the natives. The most active of these adventurers was Cerdic a Saxon, said to be the tenth in descent from Woden. He landed with his son Cenric, and as many men as he could convey in five ships, at Yarmouth in Norfolk. The provincials immediately attacked him with great vigour; but after a short engagement, they were totally defeated. Many other battles were fought, the event of which was always favourable to the Saxons, so that the Britons were forced to abandon their sea-coasts to them.

In 497, *Porta*, another Saxon, with his two sons *Bleda* and *Magla*, arrived at *Portsmouth*, so called, as some imagine, from this chieftain. The provincials, under the command of a young prince a native of the country, attempted to oppose the landing of the Saxons: but his army was defeated with great slaughter, and he himself killed in the engagement; after which Porta made himself master of all the neighbouring country. The progress of Cerdic, however, alarmed the Britons more than that of all the other Saxon princes. About the year 508, therefore, *Nazaleod*, styled, by Henry of Huntingdon, the *greatest of all the British kings*, assembled almost the whole strength of the provincial Britons in order to drive him out of the island. Cerdic, on the other hand, took care to strengthen himself by procuring assistance from all the Saxons already in the island. He then advanced against the Britons, commanding the right wing himself, and his son Cenric the left. As the two armies drew near each other, Nazaleod perceived the enemy's right wing to be much stronger than the left. He therefore attacked it with the flower of his army; and after an obstinate resistance, obliged Cerdic to save himself by flight. Being too eager in the pursuit, however, Cenric fell upon his rear, and the battle was renewed with great vigour. The British army was at last entirely defeated; and 5000 men, among whom was Nazaleod himself, were left dead on the spot.

39 Nazaleod king of Britain defeated and killed.

Who succeeded Nazaleod in the kingdom of Britain, is not known. The Welsh annals leave an interregnum of about six years, after which they place the beginning of the reign of Arthur, the most renowned British prince mentioned in history. The history of King Arthur is so much obscured by fables, and many absurd, romantic, and ridiculous stories, that some have supposed that no such person ever existed. On this subject Milton gives the following reasons against the existence of King Arthur: 1. He is not mentioned by Gildas,

40 Whether such a person as a king Arth. ever existed.

Gildas, or any Britiſh hiſtorian except Nennius, who is allowed on all hands to have been a very credulous writer, and to have publiſhed a great many fables. 2. Though William of Malmeſbury and Henry of Huntingdon have both related his exploits, yet the latter took all he wrote from Nennius; and the former, either from the ſame fabulous writer, or ſome monkiſh legends in the abbey of Glaſtenbury; for both theſe writers flouriſhed ſeveral centuries after King Arthur. 3. In the pretended hiſtory of Geoffroy of Monmouth, ſuch contradictions occur concerning this monarch's victories in France, Scotland, Ireland, Norway, Italy, &c. as muſt cauſe us to look upon him as a hero altogether fabulous and romantic.

In anſwer to this it has been ſaid, 1. That his not being mentioned by Gildas cannot ſeem ſtrange to us, ſeeing it was not that author's deſign to write an exact hiſtory of his country, but only to give a ſhort account of the cauſes of its ruin by the Scots, Picts, and Saxons. He had alſo a particular ſyſtem to ſupport, namely, That the ruin of the Britons was owing to the judgements of God upon them for their wickedneſs. He lies therefore under a great temptation to conceal the ſucceſſes of the Britons, and to relate only their misfortunes. 2. Though Nennius was a credulous writer, it is unreaſonable to think that the whole hiſtory of King Arthur was an invention of his. It is more probable that he copied it from other more ancient authors, or took it from the common tradition of his countrymen. That the Saxon annals make no mention of this king is not to be wondered at, ſeeing it is natural to think that they would wiſh to conceal the many defeats he gave their nation. 3. The moſt convincing proof of the exiſtence of King Arthur is, that his tomb was diſcovered at Glaſtenbury in Somerſetſhire, and his coffin dug up, in the reign of Henry II. with the following inſcription upon it in Gothic characters: "Hic jacet ſepultus inclytus rex Arturius in inſula Avalonia." We are told that on his body were plainly to be ſeen the marks of 10 wounds, only one of which ſeemed to be mortal.

41 His exploits.

This renowned prince is ſaid to have defeated the Saxons under Cerdic in 12 pitched battles. The laſt of theſe was fought on Badon-hill, ſuppoſed to be Banſdown near Bath; in which the Saxons received ſuch a terrible overthrow, that for many years they gave the Britons no further moleſtation. As new ſupplies of Saxons, however, were continually flocking over, a third and fourth kingdom of them were ſoon formed. The third kingdom comprehended the counties of Devon, Dorſet, Somerſet, Wiltſhire, Hampſhire, and Berkſhire; to which was afterwards added Cornwall. This was called the *kingdom of the Weſt Saxons*. The other kingdom, which was called the *kingdom of the Eaſt Saxons*, comprehended Eſſex, Middleſex, and part of Hertfordſhire.

42 Two other Saxon kingdoms erected.

In the year 542, happened the death of the great King Arthur, ſaid to have been killed in battle with a treacherous kinſman of his own. Five years afterwards was erected the Saxon kingdom of Northumberland. It extended, however, much farther than the preſent bounds of that county; for it comprehended all Yorkſhire, Lancaſhire, Durham, Cumberland, Weſtmorland, and Northumberland, with part of Scotland, as far as the Frith of Forth. Between the Saxon kings frequent contentions now aroſe; by which means the Britons enjoyed an uninterrupted tranquillity for at leaſt 44 years. This interval, however, according to Gildas, they employed only in corrupting their manners more and more, till at laſt they were roufed from their ſecurity by the ſetting up of a ſixth Saxon kingdom, called the kingdom of the *Eaſt Angles*. It was founded in 575, and comprehended the counties of Norfolk, Suffolk, Cambridgeſhire, and the Iſle of Ely. The Saxons once more attacked the Britons, and overthrew them in many battles. The war was continued for ten years; after which, another Saxon kingdom called *Mercia* was ſet up. It comprehended 17 counties; viz. Glouceſter, Hereford, Worceſter, Warwick, Leiceſter, Rutland, Northampton, Lincoln, Huntingdon, Bedford, Buckingham, Oxford, Stafford, Nottingham, Derby, Shropſhire, Cheſhire, and part of Hertfordſhire.

43 The Britons defeat the Saxons, but are obliged to retire into Wales.

The provincial Britons were now confined within very narrow bounds. However, before they entirely gave up the beſt part of their country to their enemies, they once more reſolved to try the event of a battle. At this time they were aſſiſted by the Angles, who were jealous of the overgrown power of the Weſt Saxons. The battle was fought in Wiltſhire, at Woden's Bearth, a place near the ditch called *Wanſdike* or *Wodenſdike*; which runs through the middle of the county. The battle was very obſtinate and bloody; but at laſt the Saxons were entirely defeated, and almoſt their whole army cut off. The victory, however, proved of little ſervice to the Britons: for being greatly inferior in number to the Saxons, and haraſſed by them on the one ſide, and by the Scots and Picts on the other, they were daily more and more confined; and at laſt obliged to take refuge among the craggy and mountainous places in the weſt of the iſland, where their enemies could not purſue them. At firſt they poſſeſſed all the country beyond the rivers Dee and Severn, which anciently divided Cambria, or Wales, from England; the towns which ſtand on the eaſtern banks of theſe rivers having moſtly been built in order to reſtrain the incurſions of the Welſh. But the Engliſh, having paſſed the Severn, by degrees ſeized on the country lying between that river and the Wye. Nay, in former times, ſome parts of Flintſhire and Denbighſhire were ſubject to the kings of Mercia: for Offa, the moſt powerful king of that country, cauſed a deep ditch to be drawn, and a high wall built, as a barrier between his dominions and the territories of the Welſh, from the mouth of the Dee, a little above Flint-caſtle, to the mouth of the Wye. This ditch is ſtill to be ſeen in ſeveral places; and is called by the Welſh *Claudh Offa*, or the Ditch of Offa. The inhabitants of the towns on the eaſt ſide of this ditch are called by the ſame people *Guyr y Mers*; that is, the men of Mercia.

44 Account of the heptarchy.

Thus, after a violent conteſt of near 150 years, the Saxons entirely ſubdued the Britons whom they had come to defend, and had erected ſeven independent kingdoms in England, now commonly denominated the *Saxon Heptarchy*. By theſe conquerors the country was now reduced to a degree of barbarity almoſt as great as it had been in when firſt invaded by the Romans. The provincial Britons, during their ſubjection to that people, had made conſiderable advances in civilization.

England. vilization. They had built 28 conſiderable cities, beſides a number of villages and country-ſeats; but now theſe were all levelled with the ground, the native inhabitants who remained in England were reduced to the moſt abject ſlavery, and every art and ſcience totally extinguiſhed among them.

Before theſe fierce conquerors could be civilized in any degree, it was neceſſary that all the ſeven kingdoms ſhould be reduced under one head; for as long as they remained independent, their continual wars with each other ſtill kept them in the ſame ſtate of barbarity and ignorance.

The hiſtory of theſe ſeven kingdoms affords no event that can be in the leaſt intereſting. It conſiſts only of a detail of their quarrels for the ſovereignty. This was at laſt obtained by Egbert king of the Weſt Saxons, or Weſſex, in 827. Before this time, Chriſtianity had been introduced into almoſt all the kingdoms of the heptarchy; and however much corrupted it might be by coming through the impure channel of the church of Rome, and miſunderſtood through the ignorance of thoſe who received it, it had conſiderably ſoftened the barbarous manners of the Saxons. It had alſo opened a communication between Britain and the more polite parts of Europe, ſo that there was now ſome hope of the introduction of arts and ſciences into this country. Another effect was, that, by the ridiculous notions of preſerving inviolable chaſtity even between married people, the royal families of moſt of the kingdoms were totally extinct; and the people, being in a ſtate of anarchy, were ready to ſubmit to the firſt who aſſumed any authority over them.

All theſe things contributed to the ſucceſs of Egbert in uniting the heptarchy under his own dominion. He was of the royal family of Weſſex; and a nearer heir than Brithric, who had been raiſed to the kingdom in 784. As Egbert was a prince of great accompliſhments, Brithric, knowing that he had a better title to the crown than himſelf, began to look upon him with a very jealous eye. Young Egbert, ſenſible of his danger, privately withdrew to France; where he was well received by Charlemagne, the reigning monarch. The French were reckoned at this period the moſt valiant and polite people in Europe; ſo that this exile proved of great ſervice to Egbert.

He continued at the court of France till he was recalled by the nobility to take poſſeſſion of the kingdom of Weſſex. This recal was occaſioned by the following accident. Brithric the king of Weſſex had married Eadburga, natural daughter of Offa king of Mercia; a woman infamous for cruelty and incontinence. Having great influence over her huſband, ſhe often perſuaded him to deſtroy ſuch of the nobility as were obnoxious to her; and where this expedient failed, ſhe herſelf had not ſcrupled to become their executioner. She had mixed a cup of poiſon for a young nobleman, who had acquired a great ſhare of her huſband's friendſhip: but, unfortunately, the king drank of the fatal potion along with his favourite, and ſoon after expired. By this and other crimes Eadburga became ſo odious to the people, that ſhe was forced to fly into France, while Egbert was at the ſame time recalled, as above-mentioned.

Egbert aſcended the throne of Weſſex in the year 799. He was the ſole deſcendant of thoſe conquerors who firſt invaded Britain, and who derived their pedigree from the god Woden. But though this circumſtance might have given him great advantages in attempting to ſubdue the neighbouring kingdoms, Egbert for ſome time gave them no diſturbance; but turned his arms againſt the Britons, who had retired into Cornwall, whom he defeated in ſeveral battles. He was recalled from his conqueſts in that country, by hearing that Bernulf king of Mercia had invaded his dominions. Egbert quickly led his army againſt the invaders, whom he totally defeated at Ellendun in Wiltſhire. He then entered their kingdom on the ſide of Oxfordſhire with an army, and at the ſame time ſent his eldeſt ſon Ethelwolf with another into Kent. The young prince expelled Baldred the tributary king of Kent, and ſoon made himſelf maſter of the country. The kingdom of Eſſex was conquered with equal eaſe; and the Eaſt Angles, who had been reduced under ſubjection by the Mercians, joyfully put themſelves under the protection of Egbert. Bernulf himſelf marched againſt them, but was defeated and killed; and Ludecan his ſucceſſor met with the ſame fate two years after. England

Theſe misfortunes greatly facilitated the reduction of Mercia. Egbert ſoon penetrated into the very heart of the Mercian territories, and gained an eaſy victory over a diſpirited and divided people; but in order to engage them to ſubmit with the leſs reluctance, he allowed Wiglef, their countryman, to retain the title of *king*, whilſt he himſelf exerciſed the real power of a ſovereign. Northumberland was at preſent in a ſtate of anarchy: and this tempted Egbert to carry his victorious arms into that kingdom alſo. The inhabitants, being deſirous of living under a ſettled form of government, readily ſubmitted, and owned him for their ſovereign. To them, however, he likewiſe allowed the power of electing a king; who paid him a tribute, and was dependent on him.

45 Egbert the firſt king of England.

Egbert became ſole maſter of England about the year 827. A favourite opportunity was now offered to the Anglo-Saxons of becoming a civilized people, as they were at peace among themſelves, and ſeemed free from any danger of a foreign invaſion. But this flattering proſpect was ſoon overcaſt. Five years after Egbert had eſtabliſhed his new monarchy, the Danes landed in the iſle of Shepey, plundered it, and then made their eſcape with ſafety. Encouraged by this ſucceſs, next year they landed from a fleet of 35 ſhips. They were encountered by Egbert at Charmouth in Dorſetſhire. The battle was obſtinate and bloody. Great numbers of the Danes were killed, but the reſt made good their retreat to their ſhips. They next entered into an alliance with the Britons of Cornwall; and landing two years after in that country, they made an irruption into Devonſhire. Egbert met them at Hengeſdown, and totally defeated them; but before he had time to form any regular plan for the defence of the kingdom, he died, and left the government to his ſon Ethelwolf.

46 Daniſh invaſion.

47 Ethelwolf.

The new king was weak and ſuperſtitious. He began with dividing the kingdom, which had ſo lately been united, with his ſon Athelſtan. To the young prince he gave the counties of Eſſex, Kent, and Suſſex. But though this diviſion might have been productive

England. of bad conſequences at another time, the fear of the Danes kept every thing quiet for the preſent. Theſe barbarians had ſome how or other conceived ſuch hopes of enriching themſelves by the plunder of England, that they ſcarce ever failed of paying it an annual viſit. The Engliſh hiſtorians tell us, that they met with many ſevere repulſes and defeats; but on the whole it appears that they had gained ground: for in 851 a body of them took up their winter-quarters in England. Next year they received a ſtrong reinforcement of their countrymen in 350 veſſels; and advancing from the iſle of Thanet, where they had ſtationed themſelves, they burnt the cities of London and Canterbury. Having next put to flight Brichtric the governor of Mercia, they marched into the heart of Surry, laying waſte the whole country through which they paſſed.

Ethelwolf, though naturally little fitted for military enterprifes, was now obliged to take the field. He marched againſt the Danes at the head of the Weſt Saxons, and gained an indeciſive and bloody victory over his enemies. The Danes ſtill maintained their ſettlement in the iſle of Thanet. They were attacked by Ealher and Huda, governors of Kent and Surry: both of whom they defeated and killed. Afterwards they removed to the iſle of Shepey, where they took up their winter-quarters, with a deſign to extend their ravages the next year.

The deplorable ſtate of the kingdom did not hinder Ethelwolf from making a pilgrimage to Rome, whither he carried his fourth and favourite ſon Alfred, then only ſix years of age. He paſſed a twelvemonth in that city; made preſents to the principal eccleſiaſtics there; and made a grant of 300 mancuſes (a ſilver coin about the weight of our half-crown) annually to the ſee of Rome. One-third of this was to ſupport the lamps of St Peter's, another thoſe of St Paul's, and the third was for the Pope himſelf. In his return to England, Ethelwolf married Judith, daughter of the emperor Charles the Bald; but when he landed, he found himſelf deprived of his kingdom by his ſon Ethelbald. That prince aſſumed the government of Athelſtan's dominions, who was lately dead; and, with many of Ethelwolf's nobles, formed a deſign of excluding him from the throne altogether, on account of his weakneſſes and ſuperſtitions. Ethelwolf, however, delivered the people from the calamities of a civil war, by dividing the kingdom with his ſon. He gave to Ethelbald the government of the weſtern, and reſerved to himſelf that of the eaſtern, part of the kingdom. Immediately after this, he ſummoned the ſtates of the whole kingdom, and conferred on the clergy a perpetual donation of tythes, for which they had long contended, and which had been the ſubject of their ſermons for ſeveral centuries.

This conceſſion was deemed ſo meritorious by the Engliſh, that they now thought themſelves ſure of the favour of heaven; and therefore neglected to uſe the natural means for their ſafety which they might have done. They even agreed, that, notwithſtanding the deſperate ſituation of affairs at preſent, the revenues of the church ſhould be exempted from all burdens, though impoſed for the immediate ſecurity and defence of the nation. Ethelwolf died two years after he had made the above-mentioned grant, and left the kingdom to his two eldeſt ſons Ethelbald and Ethelbert. Both theſe princes died in a few years, and left the kingdom to Ethered their brother, in the year 866. England.

43 Ethered. The whole courſe of Ethered's reign was diſturbed by the irruptions of the Danes. The king defended himſelf againſt them with great bravery, being ſeconded in all his military enterpriſes by his younger brother Alfred, who afterwards aſcended the throne. In this reign, the Danes firſt landed among the Eaſt Angles. That people treacherouſly entered into an alliance with the common enemy; and furniſhed them with horſes, which enabled them to make an irruption into Northumberland. There they ſeized upon the city of York. Oſbricht and Ælla, two Northumbrian princes who attempted to reſcue the city, were defeated and killed. Encouraged by this ſucceſs, the Danes penetrated into the kingdom of Mercia, took up their winter-quarters at Nottingham, and thus threatened the kingdom with a final ſubjection. From this poſt, however, they were diſlodged by Ethered and Alfred, who forced them to retire into Northumberland. Their reſtleſs and ſavage diſpoſition, however, did not ſuffer them to continue long in one place. They broke into Eaſt Anglia; defeated and took priſoner Edmund the tributary king of that country, whom they afterwards murdered; and committed everywhere the moſt barbarous ravages. In 871, they advanced to Reading; from whence they infeſted the neighbouring country by their incurſions. The Mercians, deſirous of recovering their independency, refuſed to join Ethered with their forces; ſo that he was obliged to march againſt the Danes, attended only by the Weſt Saxons, who were his hereditary ſubjects. Several actions enſued, in which the Danes are ſaid to have been unſucceſsful; but being continually reinforced from their own country, they became every day more and more formidable to the Engliſh. During the confuſion and diſtreſs in which the nation was now neceſſarily involved, King Ethered died of a wound he had received in an action with the Danes; and left to his brother Alfred the kingdom almoſt totally ſubdued by a foreign power.

49 Alfred the Great. Alfred, who may properly be called the founder of the Engliſh monarchy, aſcended the throne in the year 871, being then only 22 years of age. His great virtues and ſhining talents ſaved his country from ruin, which ſeemed almoſt unavoidable. His exploits againſt the Danes, his dangers and diſtreſſes, are related under the article ALFRED. Having ſettled the nation in a much better manner than could have been expected, he died in 901, leaving the kingdom to his ſecond ſon Edward the Elder.

50 Edward the elder. The beginning of this monarch's reign was diſturbed by thoſe inteſtine commotions from which the wiſe and politic Alfred had taken ſo much pains to free the nation. Ethelwald, ſon to King Ethelbert, Alfred's elder brother, claimed a right to the throne. Having armed his partiſans, he took poſſeſſion of Winburne, where he ſeemed determined to hold out to the laſt extremity. On the approach of Edward, however, with a powerful army, he firſt fled into Normandy, and afterwards into Northumberland. He hoped to find the Northumbrians ready to join him, as moſt of them were Danes, lately ſubdued by Alfred, and very impatient of peace. The event did not diſappoint his expectations.

England. pectations. The Northumbrians declared for him; and Ethelwald having thus connected himself with the Danish tribes, went beyond sea, whence he returned with a great body of these banditti. On his return, he was joined by the Danes of East Anglia and Mercia. Ethelwald, at the head of the rebels, made an irruption into the counties of Gloucester, Oxford, and Wilts; and having ravaged the country, retired with his booty before the king could approach him. Edward, however, took care to revenge himself, by conducting his forces into East Anglia, and ravaging it in like manner. He then gave orders to retire; but the Kentish men, greedy of more plunder, staid behind, and took up their quarters at Bury. Here they were assaulted by the Danes; but the Kentishmen made such an obstinate defence, that though their enemies gained the victory, it was bought by the loss of their bravest men, and, among the rest, of the usurper Ethelwald himself.

The king, now freed from the attempts of so dangerous a rival, concluded an advantageous peace with the East Angles. He next set about reducing the Northumbrians; and for this purpose equipped a fleet, hoping that thus they would be induced to remain at home to defend their own country, without attempting to invade his territories. He was disappointed in his expectations. The Northumbrians were more eager to plunder their neighbours than to secure themselves. Imagining that the whole of Edward's forces were embarked on board his fleet, they entered his territories with all the troops they could raise. The king, however, was better prepared for them than they had expected. He attacked them on their return at Tetenhall in the county of Stafford, put them to flight, recovered all the booty, and pursued them with great slaughter into their own country.

The rest of Edward's reign was a scene of continued and successful action against the Northumbrians, East Angles, the Danes of Mercia, and those who came from their native country in order to invade England. He put his kingdom in a good posture of defence, by fortifying the towns of Chester, Eddesbury, Warwick, Cherbury, Buckingham, Towcester, Maldon, Huntingdon, and Colchester. He vanquished Thurketill a Danish chieftain, and obliged him to retire with his followers into France. He subdued the East Anglians, Northumbrians, and several tribes of the Britons; and even obliged the Scots to make submissions. He died in 925, and was succeeded by Athelstan his natural son.

51 Athelstan. This prince, notwithstanding his illegitimate birth, ascended the throne without much opposition, as the legitimate children of Edward were too young to rule a nation so much liable both to foreign invasions and domestic troubles as England at present was. One Alfred, however, a nobleman of considerable power, entered into a conspiracy against him. It is said, that this nobleman was seized upon strong suspicions, but without any certain proof. He offered to swear to his innocence before the pope; and in those ages it was supposed that none could take a false oath in presence of such a sacred person, without being visited by an immediate judgment from God. Alfred was accordingly conducted to Rome, and took the oath required of him before Pope John. The words were no sooner pronounced, than he fell into convulsions, of which he England. expired in three days. The king, fully convinced of his guilt, confiscated his estate, and made a present of it to the monastery of Malmesbury.

This accident proved the means of establishing the authority of Athelstan in England. But finding the Northumbrians bore the English yoke with impatience, he gave Sithric, a Danish nobleman, the title of king of Northumberland; and in order to secure his friendship, gave him his own sister Editha in marriage. This was productive of bad consequences. Sithric died the year after his marriage with Editha; upon which Anlaf and Godfrid, Sithric's sons by a former marriage, assumed the sovereignty without waiting for Athelstan's consent. They were, however, soon obliged to yield to the superior power of that monarch. The former fled to Ireland; and the latter to Scotland, where he was protected by Constantine king of that country. The Scottish monarch was continually importuned by Athelstan to deliver up his guest, and even threatened with an invasion in case he did not comply. Constantine, detesting this treachery, advised Godfrid to make his escape. He did so, turned pirate, and died soon after. Athelstan, however, resenting this conduct of Constantine, invaded his kingdom, and reduced him, it is said, so low, that he was obliged to make the most humble submissions. This, however, is denied by all the Scottish historians.

Constantine, after the departure of Athelstan, entered into a confederacy with Anlaf, who subsisted by his piracies, and with some of the Welsh princes who were alarmed at the increase of Athelstan's power. All these confederates made an irruption into England at once; but Athelstan meeting them at Brumsbury in Northumberland, gave them a total overthrow. Anlaf and Constantine made their escape with difficulty, leaving the greatest part of their men dead on the field of battle. After this period, Athelstan enjoyed his crown in tranquillity. He died in 941, after a reign of 16 years. He passed a remarkable law, for the encouragement of commerce: viz. that a merchant, who had made three long sea voyages on his own account, should be admitted to the rank of a thane or gentleman.

52 Defeats his enemies.

Athelstan was succeeded by his brother Edmund. On his accession, he found the kingdom disturbed by the restless Northumbrians, who watched for every opportunity of rising in rebellion. They were, however, soon reduced; and Edmund took care to ensure the peace of the kingdom, by removing the Danes from the towns of Mercia where they had been allowed to settle, because it was found that they took every opportunity to introduce foreign Danes into the kingdom. He also conquered Cumberland from the Britons. This country, however, he bestowed upon Malcolm king of Scotland, upon condition that he should do homage for it, and protect the north of England from all future incursions of the Danes.

53 Edmund.

Edmund was unfortunately murdered in Gloucester, by one Leolf a notorious robber. This man had been formerly sentenced to banishment; yet had the boldness to enter the hall where the king himself dined, and to sit at table with his attendants. Edmund immediately ordered him to leave the room. The villain refused to obey; upon which the king leaped upon him,

54 Murdered by Leolf.

England. him, and seized him by the hair. Leolf then drew a dagger, and gave the king a wound, of which he instantly died, A. D. 946, being the sixth year of his reign.

55 Edred. As the children of Edmund were too young at the time of his decease, his brother Edred succeeded to the throne. The beginning of his reign, as well as those of his predecessors, was disturbed by the rebellions and incursions of the Northumbrian Danes, who looked upon the succession of every new king to be a favourable opportunity for shaking off the English yoke. On the appearance of Edred with an army, however, they immediately submitted: but before the king withdrew his forces, he laid waste their territories as a punishment for their offence. He was no sooner gone, than

56 Subdues the Northumbrians. they rose in rebellion a second time. They were again subdued; and the king took effectual precautions against their future revolts, by placing English garrisons in all their towns, and appointing an English governor to watch their motions, and suppress their in-

57 Celibacy of the clergy introduced. surrections on the first appearance. In the reign of Edred, celibacy of the clergy began to be preached up under the patronage of St DUNSTAN. This man had obtained such an ascendant over Edred, who was naturally superstitious, that he not only directed him in affairs of conscience, but in the most important matters of state. He was placed at the head of the treasury; and being thus possessed of great power at court, he was enabled to accomplish the most arduous undertakings. He professed himself a partisan of the rigid monastic rules; and having introduced celibacy among the monks of Glastenbury and Abingdon, he endeavoured to render it universal among the clergy throughout the kingdom. The monks in a short time generally embraced the pretended reformation; after which they inveighed bitterly against the vices and luxury of the age. When other topics of defamation were wanting, the marriages of clergymen became a sure object of invective. Their wives received the appellation of *concubines* or some other more opprobrious name. The secular clergy, on the other hand, who were numerous and rich, defended themselves with vigour, and endeavoured to retaliate upon their adversaries. The people were thrown into the most violent ferments; but the monks, being patronised by King Edred, gained ground greatly upon their opponents. Their progress, however, was somewhat retarded by the king's death, which happened in 955, after a reign of nine years. He left children; but as they were infants, his nephew Edwy, son to Edmund, was placed on the throne.

58 Edwy. The new king was not above 16 or 17 years of age at the time of his accession. His reign is only remarkable for the tragical story of his queen Elgiva. She was a princess of the royal blood, with whom Edwy was deeply enamoured. She was his second or third cousin, and therefore within the degrees of affinity prohibited by the canon law. Edwy, however, hearkening only to the dictates of his passion, married her, contrary to the advice of the more dignified ecclesiastics. The monks on this occasion were particularly violent; and therefore Edwy determined not to second their ambitious projects. He soon found reason to repent his having provoked such dangerous enemies. On his coronation day, while his nobility were indulging themselves in riotous mirth in a great hall where they had assembled, Edwy withdrew to another apartment to enjoy the company of his beloved queen and her mother. Dunstan guessed the reason of his absence. With unparalleled impudence, he burst into the queen's apartment; and upbraiding Edwy with his lasciviousness, as he termed it, pushed him back to the hall where the nobles were assembled. The king determined to resent such a daring insult. He required from Dunstan an account of his administration of the treasury during the late reign. The monk, probably unable to give a just account, refused to give any; upon which Edwy accused him of malversation in his office, and banished him the kingdom. England.

This proved the worst step that could possibly have been taken. Dunstan was no sooner gone than the whole nation was in an uproar about his sanctity and the king's impiety. These clamours, as they had been begun by the clergy, so they were kept up and increased by them, till at last they proceeded to the most outrageous violence. Archbishop Odo sent a party of soldiers to the palace. They seized the queen, and burned her face with a red-hot iron, in order to destroy her beauty by which she had enticed her husband; after which they carried her by force into Ireland, there to remain in perpetual exile. The king, finding it in vain to resist, was obliged to consent to a divorce from her, which was pronounced by Archbishop Odo. A catastrophe still more dismal awaited Elgiva. She had been cured of her wounds, and had even found means to efface the scars with which her persecutors had hoped to destroy her beauty. She then came to England, with a design to return to the king, whom she still considered as her husband. Unfortunately, however, she was intercepted by a party of soldiers sent for that purpose by the primate. Nothing but her most cruel death could now satisfy that wretch and his accomplices. She was hamstringed at Gloucester, and expired in a few days. 59 Tragical death of the queen.

The minds of the English were at this time so much sunk in superstition, that the monstrous inhumanity above mentioned was called a judgment from God upon Edwy and his spouse for their dissolute life, i. e. their love to each other. They even proceeded to rebellion against their sovereign; and having raised to the throne Edgar, the younger brother of Edwy, at that time only 13 years of age, they soon put him in possession of Mercia, Northumberland, and East Anglia. Edwy being thus confined to the southern counties, Dunstan returned, and took upon him the government of Edgar and his party; but the death of Edwy soon removed all difficulties, and gave Edgar peaceable possession of the government.

60 Edgar. The reign of Edgar proved one of the most fortunate mentioned in the ancient English history. He took the most effectual methods both for preventing tumults at home and invasions from abroad. He quartered a body of disciplined troops in the north, in order to repel the incursions of the Scots, and to keep the Northumbrians in awe. He built a powerful navy; and that he might keep the seamen in the practice of their duty, as well as present a formidable armament to his enemies, he commanded the fleet from time to time to make the circuit of his dominions.

England.

The greatneſs of King Edgar, which is very much celebrated by the Engliſh hiſtorians, was owing to the harmony which reigned between him and his ſubjects; and the reaſon of this good agreement was, that the king ſided with Dunſtan and the monks, who had acquired a great aſcendant over the people. He enabled them to accompliſh their favourite ſcheme of diſpoſſeſſing the ſecular canons of all the monaſteries; and he conſulted them not only in eccleſiaſtical but alſo in civil affairs. On theſe accounts, he is celebrated by the monkiſh writers with the higheſt praiſes; though it is plain, from ſome of his actions, that he was a man who could be bound neither by the ties of religion nor humanity. He broke into a convent, and carried off by force, and ravithed, a nun called *Edilda*. His ſpiritual inſtructor, Dunſtan, for this offence, obliged the king, not to ſeparate from his miſtreſs, but to abſtain from wearing his crown for ſeven years!

61 His licentious amours.

Edgar, however, was not to be ſatisfied with one miſtreſs. He happened once to lodge at the houſe of a nobleman who had a very beautiful daughter. Edgar inflamed with deſire at the ſight of the young lady, without ceremony aſked her mother to allow her to paſs a night with him. She promiſed compliance; but ſecretly ordered a waiting-maid, named *Elfleda*, to ſteal into the king's bed when the company were gone, and to retire before day-break. Edgar, however, detained her by force, till day-light diſcovered the deceit. His love was now transferred to the waiting-maid; who became his favourite miſtreſs, and maintained a great aſcendant over him till his marriage with Elfrida.

62 His marriage with Elfrida.

The circumſtances of this marriage were ſtill more ſingular and criminal than thoſe above mentioned. Elfrida was daughter and heireſs to Olgar earl of Devonſhire. She was a perſon of ſuch exquiſite beauty, that her fame was ſpread all over England, though ſhe had never been at court. Edgar's curioſity was excited by the accounts he had heard of her, and therefore formed a deſign of marrying her. He communicated his intention to Earl Athelwold his favourite; and ordered him, on ſome pretence or other, to viſit the earl of Devonſhire, and bring him a certain account concerning Elfrida. Athelwold went as he was deſired; but fell ſo deeply in love with the lady himſelf, that he reſolved to ſacrifice his fidelity to his paſſion. He returned to Edgar, and told him, that Elfrida's charms were by no means extraordinary, and would have been totally overlooked in a woman of inferior ſtation. After ſome time, however, turning the converſation again upon Elfrida, he told the king that he thought her parentage and fortune made her a very advantageous match; and therefore, if the king gave his conſent, he would make propoſals to the earl of Devonſhire on his own behalf. Edgar conſented, and Athelwold was married to Elfrida.—After his marriage, he uſed his utmoſt endeavours to keep his wife from court, that Edgar might have no opportunity of obſerving her beauty. The king, however, was ſoon informed of the truth; and told Athelwold, that he intended to pay him a viſit in his caſtle, and be made acquainted with his new-married wife. The earl could make no objections; only he deſired a few hours to prepare for the viſit. He then confeſſed the whole to Elfrida, and begged of her to appear before the king as much to the diſadvantage as poſſible. Inſtead of this, ſhe dreſſed herſelf to the greateſt advantage. Edgar immediately conceived a violent paſſion for her; and, in order to gratify it, ſeduced Athelwold into a wood under pretence of hunting, where he ſtabbed him with his own hand, and afterwards married his widow.

England.

The reign of Edgar is remarkable among hiſtorians for the encouragement he gave to foreigners to reſide at his court and throughout the kingdom. Theſe foreigners, it is ſaid, corrupted the former ſimple manners of the nation. Of this ſimplicity, however, there ſeems to be no great reaſon to boaſt; ſeeing it could not preſerve them from treachery and cruelty, the greateſt of all vices: ſo that their acquaintance with foreigners was certainly an advantage to the people, as it tended to enlarge their views, and cure them of thoſe illiberal prejudices and ruſtic manners to which iſlanders are often ſubject.—Another remarkable incident, is the extirpation of wolves from England. The king took great pleaſure in hunting and deſtroying theſe animals himſelf. At laſt he found that they had all taken ſhelter in the mountains and foreſts of Wales. Upon this he changed the tribute impoſed upon the Welſh princes by Athelſtan, into an annual tribute of 300 wolves heads; and thus produced ſuch diligence in hunting them, that the animal has never ſince appeared in England.

63 Wolves extirpated from England.

Edgar died in 957, after a reign of 16 years. He left a ſon named *Edward*, whom he had by his firſt wife the daughter of Earl Ordmer; and another, named *Ethelred*, by Elfrida. The mental qualifications of this lady were by no means anſwerable to the beauty of her perſon. She was ambitious, haughty, treacherous, and cruel. The principal nobility, therefore, were greatly averſe from the ſucceſſion of her ſon Ethelred, which would unavoidably throw too much power into the hands of his mother, as he himſelf was only ſeven years of age. Edward, afterwards ſurnamed the *Martyr*, was therefore pitched upon: and was certainly the moſt proper perſon, as he was 15 years of age, and might ſoon be able to take the government into his own hands. Elfrida oppoſed his advancement with all her might: but Dunſtan overcame every obſtacle, by anointing and crowning the young prince at Kingſton; upon which the whole kingdom ſubmitted without farther oppoſition.

64 Edward the martyr.

The only remarkable occurrence in this reign was the complete victory gained by the monks over the ſecular clergy, who were now totally expelled from the convents. Though this had been pretty nearly accompliſhed by Edgar, the ſecular clergy ſtill had partiſans in England who made conſiderable oppoſition: but theſe were all ſilenced by the following miracles. In one ſynod, Dunſtan, finding the majority of votes againſt him, roſe up, and declared that he had that inſtant received from heaven a revelation in favour of the monks. The whole aſſembly was ſo much overawed by this intelligence, that they proceeded no farther in their deliberations. In another ſynod, a voice iſſued from the crucifix, acquainting the members, that the eſtabliſhment of the monks was founded on the will of heaven, and could not be oppoſed without impiety. But the third miracle was ſtill more alarming. In another

65 Miracles of St Dunſtan.

England. other ſynod the floor of the hall ſank, and great numbers of the members were killed or bruiſed by their fall. It was remarked that Dunſtan had that day prevented the king from attending the ſynod, and that the beam on which his own chair ſtood was the only one which did not ſink. Theſe circumſtances, inſtead of making him ſuſpected as the author of the miracle, were regarded as proofs of the interpoſition of Providence in his favour.

Edward lived four years after he was raiſed to the throne, in perfect innocence and ſimplicity. Being incapable of any treacherous intention himſelf, he ſuſpected none in others. Though his ſtepmother had oppoſed his ſucceſſion, he had always behaved towards her with the greateſt reſpect; and expreſſed on all occaſions the moſt tender affection for his brother Ethelred. Being one day hunting in the neighbourhood of the caſtle where Elfrida reſided, he paid her a viſit unattended by any of his retinue. After mounting his horſe with a deſign to return, he deſired ſome liquor
66 to be brought him. But while he was holding the cup
The king murdered. to his head, a ſervant of Elfrida ſtabbed him behind. The king, finding himſelf wounded, clapped ſpurs to his horſe; but ſoon becoming faint by the loſs of blood, he fell from the ſaddle, and his foot being entangled in the ſtirrup, he was dragged along till he expired. His body was found and privately interred at Wereham by his ſervants. The Engliſh had ſuch compaſſion for this amiable prince, that they beſtowed on him the appellation of *Martyr*, and even fancied that miracles were wrought at his tomb. Elfrida built monaſteries, and ſubmitted to many penances, in order to atone for her guilt; but, even in that barbarous age, ſhe could never regain the good opinion of the public.

67 Ethelred. After the murder of Edward, his brother Ethelred ſucceeded to the throne without oppoſition. As he was a minor when he was raiſed to the throne, and, even when he came to man's eſtate, never diſcovered any vigour or capacity of defending the kingdom againſt invaders, the Danes began to renew their incurſions. Before they durſt attempt any thing of importance, however, they firſt made a ſmall incurſion by way of
68 trial. In the year 981, they landed in Southampton
England invaded and ruined by the Danes. from ſeven veſſels; and having ravaged the country, they retired with impunity, carrying a great booty along with them. In 987, they made a ſimilar attempt on the weſt coaſt, and were attended with the like ſucceſs. Finding that matters were now in a favourable ſituation for their enterpriſes, they landed in Eſſex under the command of two chieftains; and, having defeated and killed Brithnot duke of that county, laid waſte all the neighbouring provinces. In this extremity, Ethelred, ſurnamed, on account of his prepoſterous conduct, the *Unready*, bribed the enemy with 10,000l. to depart the kingdom. This advice was given by Siricius archbiſhop of Canterbury, and ſome of the degenerate nobility; and was attended with the ſucceſs that might have been expected. The Danes appeared next year off the eaſtern coaſt. But, in the mean time, the Engliſh had determined to aſſemble at London a fleet capable of repulſing the enemy. This failed of ſucceſs through the treachery of Alfric duke of Mercia. Having been formerly baniſhed the kingdom, and found great difficulty in getting himſelf reſtored to his former dignity, he truſted thenceforth, not to his ſervices or the affections of his countrymen, but to the influence he had over his vaſſals, and to the public calamities. Theſe laſt he determined always to promote as far as he could: becauſe in every revolution his aſſiſtance would be neceſſary, and conſequently he muſt received a continual acceſſion of power. The Engliſh had formed a plan for ſurrounding and deſtroying the Daniſh fleet in the harbour; but Alfric not only gave the enemy notice of this deſign, but alſo deſerted with his ſquadron the night before the engagement. The Engliſh by this means proved unſucceſsful; and Ethelred, in revenge, took Alfgar, Alfric's ſon, and ordered his eyes to be put out. This piece of cruelty could be productive of no good effect. Alfric had become ſo powerful, that, notwithſtanding his treachery, it was found impoſſible to deprive him of the government of Mercia. England.

In 993, the Danes under the command of Sweyn their king, and the Norwegians conducted by Olave king of that country, ſailed up the Humber, and deſtroyed all around them. A powerful army was aſſembled to oppoſe theſe invaders; but through the treachery of the three leaders, all men of Daniſh extraction, the Engliſh were totally defeated. Encouraged by this ſucceſs, the Danes entered the Thames in 94 veſſels, and laid ſiege to London. The inhabitants, however, made ſuch a brave defence, that the beſiegers were finally obliged to give over the attempt. Out of revenge for this diſappointment, they laid waſte Eſſex, Suſſex, and Hampſhire. In theſe counties they procured horſes; by which means they were enabled to penetrate into the more inland parts, and threatened the kingdom with total ſubjection. Ethelred and his nobles had now recourſe to their former expedient. They ſent ambaſſadors to the two northern kings, to whom they promiſed ſubſiſtence and tribute, provided they would, for the preſent, put an end to their ravages, and ſoon after depart the kingdom. They agreed to the terms, and peaceably took up their quarters at Southampton. Olave even paid a viſit to Ethelred, and received the rite of confirmation from the Engliſh biſhops. The king alſo made him many preſents; and Olave promiſed never more to infeſt the Engliſh territories; which promiſe it is ſaid he afterwards religiouſly obſerved.

After the departure of Olave with his Norwegians, Sweyn, though leſs ſcrupulous than the king of Norway, was obliged to leave the kingdom alſo. But this ſhameful compoſition procured only a ſhort relief to the nation. The Danes ſoon after appeared in the Severn; and having ravaged Wales as well as Cornwall and Devon, they ſailed round, and, entering the mouth of the Tamar, completed the ruin of theſe two counties. Then, returning to the Briſtol channel, and penetrating into the country by the Avon, they overran all that country, and carried fire and ſword even into Dorſetſhire. In 998, they changed the ſeat of war; and, after ravaging the iſle of Wight, they entered the Thames and Medway, where they laid ſiege to Rocheſter and defeated the Kentiſh men in a great battle. After this victory, the whole province of Kent was made a ſcene of ſlaughter and devaſtation. The extremity of theſe miſeries forced the Engliſh into counſels for common defence both by ſea and land: but the weakneſs of the king, the diviſions among the nobility, the treachery of ſome, the cowardice of others,

&c

England. the want of concert in all, fruſtrated every endeavour; and their fleets and armies either came too late to attack the enemy, or were repulſed with diſhonour. The Engliſh, therefore, devoid both of prudence and unanimity in council, had recourſe to the expedient which by experience they had found to be ineffectual. They offered the Danes a large ſum if they would conclude a peace and depart the kingdom. Theſe ravagers continually roſe in their demands; and now required the payment of 24,000l. which the Engliſh ſubmitted to give. The departure of the Danes procured them a temporary relief; which they enjoyed as if it was to be perpetual, without making any effectual preparations for giving them a more vigorous reception upon their next return.

Beſides the receiving this ſum, the Danes were at preſent engaged by another motive to depart from England. They were invited over by their countrymen in Normandy, who at this time were hard preſſed by Robert king of France, and who found it difficult to defend their ſettlements againſt him. It is probable alſo, that Ethelred, obſerving the cloſe connection of all the Danes with one another, however they might be divided in government or ſituation, was deſirous of procuring an alliance with that formidable people. For this purpoſe, being at preſent a widower, he made his addreſſes to Emma, ſiſter to Richard II. duke of Normandy. He ſoon ſucceeded in his negotiations; the princeſs came over to England, and was married to the king in the year 1001.

69 Marriage of the king with the princeſs of Normandy.

Though the Danes had been for a long time eſtabliſhed in England, and though the ſimilarity of their language with the Saxon had invited them to an early coalition with the natives; thay had as yet found ſo little example of civilized manners among the Engliſh, that they retained all their ancient ferocity, and valued themſelves only on their national character of military bravery. The Engliſh princes had been ſo well acquainted with their ſuperiority in this reſpect, that Athelſtan and Edgar had been accuſtomed to keep in pay large bodies of Daniſh troops, who were quartered about the country, and committed many violences upon the inhabitants. Theſe mercenaries had attained to ſuch a height in luxury, according to the old Engliſh writers, that they combed their hair once a-day, bathed themſelves once a-week, changed their clothes frequently; and by all theſe arts of effeminacy, as well as by their military character, had rendered themſelves ſo agreeable to the fair ſex, that they debauched the wives and daughters of the Engliſh, and had diſhonoured many families. But what moſt provoked the inhabitants was, that, inſtead of defending them againſt invaders, they were always ready to betray them to the foreign Danes, and to aſſociate themſelves with every ſtraggling party which came from that nation. England.

70 Danes maſſacred.

The animoſities between the native Engliſh and the Danes who inhabited among them, had from theſe cauſes riſen to a great height; when Ethelred, from a policy commonly adopted by weak princes, took the cruel reſolution of maſſacring the Danes throughout the kingdom. On the 13th of November 1002, ſecret orders were diſpatched to commence the execution everywhere on the ſame day; and the feſtival of St Brice, which fell on a Sunday, the day on which the Danes uſually bathed themſelves, was choſen for this purpoſe. Theſe cruel orders were executed with the utmoſt exactneſs. No diſtinction was made betwixt the innocent and the guilty; neither ſex nor age was ſpared; nor were the cruel executioners ſatisfied without the tortures, as well as death, of the unhappy victims. Even Gunilda, ſiſter to the king of Denmark, who had married Earl Paling, and had embraced Chriſtianity, was, by the advice of Edric earl of Wilts, ſeized and condemned to death by Ethelred, after ſeeing her huſband and children butchered before her face. This unhappy princeſs foretold, in the agonies of deſpair, that her murder would ſoon be avenged by the total ruin of the Engliſh nation (A).

71 New invaſion by Sweyn.

The prophecy of Gunilda was exactly fulfilled. In 1003, Sweyn and his Danes, who wanted only a pretence to renew their invaſions, appeared off the weſtern coaſt, and threatened revenge for the ſlaughter of their countrymen. The Engliſh took meaſures for repulſing the enemy; but theſe were defeated through the treachery firſt of Alfric, and then of Edric, a ſtill greater traitor, who had married the king's daughter, and ſucceeded Alfric in the command of the Britiſh armies. The Danes therefore ravaged the whole country. Agriculture was neglected, a famine enſued, and the kingdom was reduced to the utmoſt degree of miſery. At laſt the infamous expedient of buying a peace was recurred to; and the departure of the Danes was purchaſed, in 1007, at the expence of 30,000l.

The Engliſh endeavoured to employ this interval in making preparations againſt the return of the Danes, which they had reaſon ſoon to expect. A law was made, ordering the proprietors of eight hides of land to provide themſelves of a horſeman and a complete ſuit of armour; and thoſe of 310 hides to equip a ſhip for the defence of the kingdom. By this means a formidable armament was raiſed. There were 243,600 hides in England; conſequently the ſhips equipped muſt be 785. The cavalry was 30,450 men. All hopes of ſucceſs from this equipment, however, were diſappointed by the factions, animoſities, and diſſenſions

(A) On the ſubject of this maſſacre, Mr Hume has the following obſervations: "Almoſt all the ancient hiſtorians ſpeak of this maſſacre of the Danes as if it had been univerſal, and as if every individual of that nation throughout England had been put to death. But the Danes were almoſt the ſole inhabitants in the kingdoms of Northumberland and Eaſt Anglia, and were very numerous in Mercia. This repreſentation of the matter was abſolutely impoſſible. Great reſiſtance muſt have been made, and violent wars enſued: which was not the caſe. This account given by Wallingford, though he ſtands ſingle, muſt be admitted as the only true one. We are told that the name of *Iurdane*, *lord Dane*, for an idle lazy fellow who lives at other people's expence, came from the conduct of the Danes who were put to death. But the Engliſh princes had been entirely maſters for ſeveral generations; and only ſupported a military corps of that nation. It ſeems probable, therefore, that theſe Danes only were put to death."

England. tions of the nobility. Edric had cauſed his brother Brightric to advance an accuſation of treaſon againſt Wolfnoth governor of Suſſex, the father of the famous Earl Godwin; and that nobleman, knowing the power and malice of his enemy, conſulted his own ſafety by deſerting with 20 ſhips to the Danes. Brightric purſued him with a fleet of 80 ſail; but his ſhips being ſhattered in a tempeſt, and ſtranded on the coaſt, he was ſuddenly attacked by Wolfnoth, and all his veſſels were burnt or otherwiſe deſtroyed. The treachery of Edric fruſtrated every plan of future defence; and the whole navy was at laſt ſcattered into the ſeveral harbours.

By theſe fatal miſcarriages, the enemy had leiſure to overrun the whole kingdom. They had now got ſuch a footing, indeed, that they could hardly have been expelled though the nation had been ever ſo unanimous. But ſo far did mutual diffidence and diſſenſion prevail, that the governors of one province refuſed to march to the aſſiſtance of another; and were at laſt terrified from aſſembling their forces for the defence of their own. At laſt the uſual expedient was tried. A peace was bought with 48,000l.; but this did not procure even the uſual temporary relief. The Danes, knowing that they were now maſters of the kingdom, took the money, and continued their devaſtations. They levied a new contribution of 8000l. on the county of Kent alone; murdered the archbiſhop of Canterbury, who had refuſed to countenance this exaction; and the Engliſh nobility ſubmitted everywhere to the Daniſh monarch, ſwearing allegiance to him, and giving hoſtages for their good behaviour. At laſt, Ethelred himſelf, dreading equally the violence of the enemy and the treachery of his own ſubjects, fled into Normandy, whither he had already ſent Queen Emma and her two ſons Alfred and Edward. The duke received his unhappy gueſts with a generoſity which does honour to his memory.

72 Ethelred flies to Normandy.

The flight of King Ethelred happened in the end of the year 1013. He had not been above ſix weeks in Normandy, when he heard of the death of Sweyn, which happened at Gainſborough before he had time to eſtabliſh himſelf in his new dominions. At the ſame time he received an invitation from the prelates and nobility to reſume the kingdom; expreſſing alſo their hopes, that, being now better taught by experience, he would avoid thoſe errors which had been ſo fatal to himſelf and his people. But the miſconduct of Ethelred was incurable; and, on his reſuming the government, he behaved in the very ſame manner that he had done before. His ſon-in-law Edric, notwithſtanding his repeated treaſons, retained ſuch influence at court, that he inſtilled into the king jealouſies of Sigefert and Morcar, two of the chief nobles of Mercia. Edric enticed them into his houſe, where he murdered them; while Ethelred partook of the infamy of this action, by confiſcating their eſtates, and confining the widow of Sigefert in a convent. She was a woman of ſingular beauty and merit; and in a viſit which was paid her, during her confinement, by Prince Edmund the king's eldeſt ſon, ſhe inſpired him with ſo violent an affection, that he releaſed her from the convent, and ſoon after married her without his father's conſent.

73 Returns, but behaves as ill as ever.

In the mean time, Canute, the ſon and ſucceſſor of Sweyn, proved an enemy no leſs terrible to the Engliſh than his father had been. He ravaged the eaſtern coaſt with mercileſs fury; and put aſhore all the Engliſh hoſtages at Sandwich, after having cut off their hands and noſes. He was at laſt obliged, by the neceſſity of his affairs, to return to Denmark. In a ſhort time, however, he returned, and continued his depredations along the ſouthern coaſt. He then broke into the counties of Dorſet, Wilts, and Somerſet; where an army was aſſembled againſt him under the command of Prince Edmund and Duke Edric. The latter ſtill continued his perfidious machinations; and after endeavouring in vain to get the prince into his power, found means to diſſipate the army, and then deſerted to Canute with 40 veſſels. England.

Edmund was not diſheartened by this treachery. He again aſſembled his forces, and was in a condition to give the enemy battle. Ethelred, however, had now ſuch frequent experience of the treachery of his ſubjects, that he had loſt all confidence in them. He remained in London, pretending ſickneſs, but in reality from an apprehenſion that they intended to buy their peace by delivering him into the hands of his enemies. The army called aloud for their ſovereign to march at their head againſt the Danes; and on his refuſal to take the field, they were ſo diſcouraged, that all the preparations which had been made became ineffectual for the defence of the kingdom. Edmund, deprived of all regular reſources for the maintenance of the ſoldiers, was obliged to commit ſimilar ravages to thoſe practiſed by the Danes; and after making ſome fruitleſs expeditions into the north, which had ſubmitted entirely to Canute's power, he returned to London, where he found every thing in confuſion by the death of the king.

Ethelred died in 1016, after an unhappy reign of 35 years; and was ſucceeded by his eldeſt ſon Edmund, ſurnamed *Ironſide* on account of his great ſtrength and valour. He poſſeſſed abilities ſufficient to have ſaved his country from ruin, had he come ſooner to the throne; but it was now too late. He bravely oppoſed the Danes, however, notwithſtanding every diſadvantage; till at laſt the nobility of both nations obliged their kings to come to a compromiſe, and divide the kingdom between them by treaty. Canute reſerved to himſelf Mercia, Eaſt Anglia, and Northumberland, which he had entirely ſubdued. The ſouthern parts were left to Edmund. This prince ſurvived the treaty only about a month; being murdered at Oxford by two of his chamberlains, accomplices of Edric.

74 Edmund Ironſide divides the kingdom with the Danes.

After the death of Edmund, nothing was left for the Engliſh but ſubmiſſion to Canute. The leaſt ſcrupulous of mankind, however, dare not at all times openly commit injuſtice. Canute therefore, before he ſeized the dominions of Edwin and Edward, the two ſons of Edmund, ſuborned ſome of the nobility to depoſe, that, in the laſt treaty with Edmund, it had been verbally agreed, that, in caſe of Edmund's death, Canute ſhould either be ſucceſſor to his dominions, or tutor to his children; for hiſtorians differ with regard to this particular. This evidence, ſupported by the great power of Canute, was ſufficient to get him elected king of England. Immediately after his acceſſion to the throne, he ſent the two ſons of Edmund to the court of Sweden, on pretence of being there educated; but

75 Canute

England. but charged the king to put them to death as ſoon as they arrived. The Swediſh monarch did not comply with this requeſt; but ſent them to Solomon king of Hungary, to be educated in his court. The elder, Edwin, was afterwards married to Solomon's ſiſter: but he dying without iſſue, that prince gave his ſiſter-in-law, Agatha, daughter of the emperor Henry II. in marriage to Edward, the younger brother; and ſhe bore him Edgar Atheling; Margaret, afterwards queen of Scotland; and Chriſtina, who retired into a convent.

Canute was obliged at firſt to make great conceſſions to the nobility: but he afterwards put to death many of thoſe in whom he could not put confidence; and, among the reſt, the traitor Edric himſelf, who was publicly executed, and his body thrown into the Thames.

76 Marries Ethelred's widow. In order to prevent any danger from the Normans, who had threatened him with an invaſion, he married Emma the widow of Ethelred, and who now came over from Normandy; promiſing that he would leave the children he ſhould have by that marriage heirs to the crown after his deceaſe. The Engliſh were at firſt diſpleaſed with Emma for marrying the mortal enemy of her former huſband; but at the ſame time were glad to find at court a ſovereign to whom they were accuſtomed, and who had already formed connections with them: and thus Canute, beſides ſecuring by his marriage the alliance with Normandy, gradually acquired by the ſame means the confidence of his own people.

The moſt remarkable tranſaction in this prince's reign, beſides thoſe mentioned under the article CANUTE, is his expedition to Scotland againſt Malcolm king of that country, whom he forced to do homage for the county of Cumberland, which the Scots at that time poſſeſſed. After this enterpriſe, Canute paſſed four years in peace, and died at Shaftſbury; leaving three ſons, Sweyn, Harold, and Hardicanute. Sweyn, whom he had by his firſt marriage with Alfwen, daughter of the earl of Hampſhire, was crowned in Norway; Hardicanute, whom Emma had born, was in poſſeſſion of Denmark; and Harold, who was of the ſame marriage with Sweyn, was at that time in England.

77 Harold. Harold ſucceeded to the crown of England; though it had been ſtipulated that Emma's ſon, Hardicanute, ſhould be heir to that kingdom. This advantage Harold obtained by being on the ſpot, and getting poſſeſſion of his father's treaſures, while Hardicanute was at a diſtance. As Hardicanute, however, was ſupported by Earl Godwin, a civil war was likely to enſue, when a compromiſe was made; by which it was agreed, that Harold ſhould enjoy London, and all the provinces north of the Thames, while the poſſeſſion of the ſouth ſhould remain to Hardicanute: and till that prince ſhould appear and take poſſeſſion of his dominions, Emma fixed her reſidence at Wincheſter, and ruled her ſon's part. Harold reigned four years; during which time, the only memorable action he performed was a moſt infamous piece of treachery.—Alfred and Edward, the two ſons of Emma by Ethelred, paid a viſit to their mother in England. But, in the mean time, Earl Godwin being gained over by Harold, a plan was laid for the deſtruction of the two princes. Alfred was accordingly invited to London by Harold,

78 His treachery and cruelty.

with many profeſſions of friendſhip; but when he had reached Guildford, he was ſet upon by Godwin's vaſſals: about 600 of his train were murdered in the moſt cruel manner; he himſelf was taken priſoner, his eyes were put out, and he was conducted to the monaſtery of Ely, where he died ſoon after. Edward and Emma, appriſed of the fate which awaited them, fled beyond ſea, the former into Normandy, the latter into Flanders; while Harold took poſſeſſion of all his brother's dominions without oppoſition.—He died in April 1039. England.

Hardicanute ſucceeded his brother Harold without oppoſition. His government was extremely violent and tyrannical. However, it was but of ſhort duration. He died, in 1041, of a debauch at the marriage of a Daniſh lord. After his death, a favourable opportunity was offered to the Engliſh for ſhaking off the Daniſh yoke. Sweyn, king of Norway, the eldeſt ſon of Canute, was abſent; and as the two laſt kings had died without iſſue, there appeared none of that race whom the Danes could ſupport as ſucceſſor to the throne. For this reaſon, the eyes of the nation were naturally drawn towards Prince Edward, who happened to be at court when the king died. There were ſome reaſons, however, to fear, that Edward's ſucceſſion would be oppoſed by Earl Godwin, who was by far the moſt powerful nobleman in the kingdom. A declared animoſity ſubſiſted between Edward and Godwin, on account of the hand which the latter had in the murder of his brother Alfred; and this was thought to be an offence of ſo grievous a nature, that Edward could never forgive it. But here their common friends interpoſed; and repreſenting the neceſſity of their good correſpondence, obliged them to lay aſide their animoſities, and to concur in reſtoring liberty to their native country. Godwin only ſtipulated, that Edward, as a pledge of his ſincere reconciliation, ſhould promiſe to marry his daughter Editha. This propoſal was agreed to; Edward was crowned king of England, and married Editha as he had promiſed. The marriage, however, proved rather a ſource of diſcord than otherwiſe between the king and Godwin. Editha, though a very amiable woman, could never obtain the confidence and affection of her huſband. It is even ſaid that during the whole courſe of her life he abſtained from all matrimonial converſe with her; and this ridiculous behaviour was highly celebrated by the monkiſh writers of the age, and contributed to the king's acquiring the title of Saint and Confeſſor.

79 Edward the Confeſſor.

Though the neglect of his daughter could not fail to awaken Godwin's former enmity againſt King Edward, it was neceſſary to chooſe a more popular ground before he could vent his complaints againſt the king in a public manner. He therefore choſe for his theme the influence which the Normans had on the affairs of government; and declared oppoſition took place between him and theſe favourites. In a ſhort time, this animoſity openly broke out with great violence. Euſtace count of Boulogne having paid a viſit to the king, paſſed by Dover on his return. One of his train being refuſed acceſs to a lodging which had been appointed for him, attempted to make his way by force, and wounded the maſter of the houſe in the conteſt. The townſmen revenged this inſult by the death of the ſtranger; the count and his train took arms, and murdered

80 Variance of the king and earl Godwin.

England. murdered the townſman in his houſe. A tumult enſued; near 20 perſons were killed on each ſide; and Euſtace being overpowered with numbers, was at laſt obliged to fly. He complained to the king; who gave orders to Earl Godwin, in whoſe government Dover lay, to puniſh the inhabitants. But this nobleman refuſed to obey the command, and endeavoured to throw the whole blame on Count Euſtace and his followers. The king was diſpleaſed; and threatened to make him feel the utmoſt effects of his reſentment, in caſe he finally refuſed to comply. Upon this, Godwin aſſembled a powerful army, on pretence of repreſſing ſome diſorders on the frontiers of Wales; but, inſtead of this, marched directly to Glouceſter, where the king at that time was without any military force, as ſuſpecting no danger.

Edward, perceiving his danger, applied to Siward duke of Northumberland, and Leofric duke of Mercia, two very powerful noblemen. They haſtened to him with ſuch followers as they could aſſemble, iſſuing orders at the ſame time for all the forces under their reſpective governments to march without delay to the defence of the king. Godwin, in the mean time, ſuffered himſelf to be deceived by negociations, till the king's army became ſo powerful, that he was not able to cope with it. He was therefore obliged to fly with his family to Flanders. Here he was protected by Baldwin earl of that country, together with his three ſons, Gurth, Sweyn, and Toſti; the laſt of whom had married Baldwin's daughter. Harold and Leofwin, two other ſons of Godwin, took ſhelter in Ireland.

81 Godwin flies to Flanders.

After the flight of Earl Godwin, he was proceeded againſt as a traitor by King Edward. His eſtates, and thoſe of his ſons, were confiſcated; his governments given to others; Queen Editha was confined in a monaſtery; and the great power of this family, which had become formidable to the crown itſelf, ſeemed to be totally overthrown. Godwin, however, ſoon found means to retrieve his affairs. Having hired ſome ſhips, and manned them with his followers, he attempted to make a deſcent at Sandwich. The king, informed of his preparations, equipped a fleet which Godwin could not reſiſt, and he therefore retreated into the Flemiſh harbours. On his departure, the Engliſh diſmiſſed their armament. This Godwin had expected, and therefore kept himſelf in readineſs for the favourable opportunity. He immediately put to ſea, and ſailed to the iſle of Wight, where he was joined by Harold with a ſquadron which he had collected in Ireland. Being thus maſter of the ſea, Godwin entered the harbours on the ſouthern coaſt; ſeized all the ſhips; and being joined by great numbers of his former vaſſals, he ſailed up the Thames, and appeared before London.

82 Returns, and is reconciled with the king.

The approach of ſuch a formidable enemy threw every thing into confuſion. The king alone ſeemed reſolute to defend himſelf to the laſt extremity; but the interpoſition of many of the nobility, together with the ſubmiſſions of Godwin himſelf, at laſt produced an accommodation. It was ſtipulated, that Godwin ſhould give hoſtages for his good behaviour, and that all the foreigners ſhould be baniſhed the kingdom; after which, Edward, ſenſible that he had not power ſufficient to detain the earl's hoſtages in England, ſent them over to his kinſman the young duke of Normandy. England.

Soon after this reconciliation, Godwin died as he was ſitting at table with the king. He was ſucceeded in the government of Weſſex, Suſſex, Kent, and Eſſex, and the office of ſteward of the houſehold, a place of great power, by his ſon Harold. The ſon was no leſs ambitious than his father had been; and as he was a man of much greater abilities, he became a more dangerous enemy to Edward than even Godwin had been. Edward knew no better expedient to prevent the increaſe of Harold's power, than by giving him a rival. This was Algar ſon of Leofric duke of Mercia, whom he inveſted with the government of Eaſt Anglia, which had formerly belonged to Harold. The latter however, after ſome broils, finally got the better of his rival, and baniſhed him the kingdom. Algar returned ſoon after with an army of Norwegians, with whom he invaded Eaſt Anglia; but his death in a ſhort time freed Harold from all further apprehenſions from that quarter. His power was ſtill further increaſed in a ſhort time after by the acceſſion of his brother Toſti to the government of Northumberland; and Edward now declining in years, and apprehenſive that Harold would attempt to uſurp the crown after his death, reſolved to appoint a ſucceſſor. He therefore ſent a deputation into Hungary, to invite over his nephew, Edward, ſon to his elder brother, who was the only remaining heir of the Saxon line. That prince accordingly came over with his children, Edgar Atheling, Margaret, and Chriſtina; but died a few days after his arrival. His death threw the king into greater perplexity than ever. Being reſolved to exclude Harold if poſſible, he ſecretly caſt his eye on his kinſman William duke of Normandy; a perſon of whoſe power, character, and capacity, he had juſtly a very high opinion. This advice had formerly been given him by Robert archbiſhop of Canterbury, who was himſelf a Norman, and had been baniſhed along with the reſt upon the return of Earl Godwin. But Edward finding that the Engliſh would more eaſily acquieſce in the reſtoration of the Saxon line, had in the mean time invited his brother's deſcendants from Hungary, as already mentioned. The death of his nephew, and the inexperience and unpromiſing qualities of young Edgar, made him reſume his former intentions in favour of the duke of Normandy, though his averſion to hazardous enterpriſes engaged him to poſtpone the execution, and even to keep his purpoſe concealed from all his miniſters.

83 Hiſtory of Harold aſpires to the crown.

Harold in the mean time increaſed his popularity by all poſſible means, in order to prepare his way for being advanced to the throne after the death of Edward, which now ſeemed to be faſt approaching. He had no ſuſpicion of the duke of Normandy as a rival; but as he knew that a ſon and grandſon of the Earl Godwin were in the hands of that prince as hoſtages, he feared that they might be made uſe of as checks upon his ambition, in caſe he attempted afterwards to aſcend the throne. He therefore prevailed upon Edward to releaſe theſe hoſtages unconditionally; and having obtained his conſent, he ſet out for Normandy himſelf, attended by a numerous retinue. He was driven by a tempeſt on the territory of Guy count of

England. Ponthieu, who detained him priſoner, and demanded an exorbitant ſum for his ranſom. Harold found means to acquaint William with his ſituation. The duke of Normandy, deſirous of gaining Harold over to his party, commanded Guy to reſtore his priſoner to his liberty. Upon this Harold was immediately put into the hands of the Norman ambaſſador, who conducted him to Rouen. William received him with great demonſtrations of reſpect and friendſhip; but ſoon took an opportunity of acquainting him with his pretenſions to the crown of England, and aſked his aſſiſtance in the execution of his ſcheme. Harold was ſurpriſed with this declaration of the duke; but being entirely in his power, he feigned a compliance with his deſires, and promiſed to ſecond to the utmoſt of his ability the will of King Edward. William, to ſecure him as much as poſſible to his intereſt, promiſed him his daughter in marriage, and required him to take an oath that he would fulfil his promiſes. Harold readily complied; but to make the oath more binding, William privately conveyed under the altar where the oath was taken relicks of ſome of the moſt revered martyrs; and when Harold had taken the oath, he ſhowed him the relicks, and admoniſhed him to obſerve religiouſly ſuch a ſolemn engagement.

Harold was no ſooner ſet at liberty, than he found himſelf maſter of caſuiſtry ſufficient to excuſe the breaking of his oath, which had been extorted from him, and which, if kept, might be attended with the ſubjection of his country to a foreign power. He continued to practiſe every art to increaſe his popularity; and about this time, two accidents enabled him to add much to that character which he had already ſo well eſtabliſhed. The Welſh had for ſome time made incurſions into the Engliſh territories, and had lately become ſo troubleſome, that Harold thought he could not do a more acceptable piece of ſervice to the public, than undertake an expedition againſt theſe invaders. Having therefore prepared ſome light-armed foot to purſue the natives into their fortreſſes, ſome cavalry to ſecure the open country, and a ſquadron of ſhips to attack the ſea-coaſts, he employed all theſe forces againſt the enemy at once; and thus reduced them to ſuch diſtreſs, that they were obliged to purchaſe peace by ſending their prince's head to Harold, and ſubmitting to the government of two Welſh noblemen appointed by Edward.

The other incident was no leſs honourable to Harold. Toſti his brother had been created duke of Northumberland; but being of a violent tyrannical temper, had treated the inhabitants with ſuch cruelty, that they roſe in rebellion againſt him, and drove him from his government. Morcar and Edwin, two brothers, grandſons of the great Duke Leofric, joined in the inſurrection; and the former being elected duke, advanced with an army to oppoſe Harold, who had been commiſſioned by the king to reduce and puniſh the Northumbrians. Before the armies engaged, Morcar endeavoured to juſtify his conduct, and repreſented to Harold, that Toſti had behaved in ſuch a manner, that no one, not even a brother, could defend him without participating of the infamy of his conduct: that the Northumbrians were willing to ſubmit to the king, but required a governor that would pay ſome attention to their privileges; and they truſted that Harold would not defend in another that violent conduct from which his own government had always kept at ſo great a diſtance. This ſpeech was accompanied by ſuch a detail of well ſupported facts, that Harold abandoned his brother's cauſe; and returning to Edward, perſuaded him to pardon the Northumbrians, and confirm Morcar in his government. He even married the ſiſter of that nobleman; and by his intereſt procured Edwin the younger brother to be choſen governor of Mercia. Toſti, in a rage, departed the kingdom, and took ſhelter in Flanders with Baldwin his father-in-law; while William of Normandy ſaw that now he had nothing to expect from Harold, who plainly intended to ſecure the crown for himſelf. England.

84 Harold ſucceeds Edward the Confeſſor.

Edward died in 1067, and was ſucceeded by Harold with as little oppoſition as though he had been the lawful heir. The very day after Edward's death, he was anointed and crowned by the archbiſhop of York. The whole nation ſeemed joyfully to ſwear allegiance to him. But he did not long enjoy the crown, to obtain which he had taken ſo much pains, and which he ſeemed to have ſuch capacity for wearing. His brother Toſti, provoked at his ſucceſs, ſtirred up againſt him every enemy he could have any influence with. The duke of Normandy alſo was enraged to the laſt degree at the perfidy of Harold; but before he commenced hoſtilities, he ſent an embaſſy to England, upbraiding the king with his breach of faith, and ſummoning him to reſign the kingdom immediately. Harold replied, that the oath, with which he was reproached, had been extorted by the well grounded fear of violence, and for that reaſon could never be regarded as obligatory: that he never had any commiſſion either from the late king or the ſtates of England, who alone could diſpoſe of the crown, to make any tender of the ſucceſſion to the duke of Normandy; and if he, a private perſon, had aſſumed ſo much authority, and had even voluntarily ſworn to ſupport the duke's pretenſions, the oath was unlawful, and it was his duty to take the firſt opportunity of breaking it: that he had obtained the crown by the unanimous ſuffrages of the people; and ſhould ſhow himſelf totally unworthy of their favour, did he not ſtrenuouſly maintain thoſe liberties with which they had entruſted him; and that the duke, if he made any attempt by force of arms, ſhould experience the power of an united nation, conducted by a prince, who, ſenſible of the obligations impoſed on him by his royal dignity, was determined, that the ſame moment ſhould put a period to his life and to his government.

This anſwer was according to William's expectations; and therefore he had already made preparations for invading England. He was encouraged and aſſiſted in this enterpriſe by Howel count of Britanny, Baldwin earl of Flanders, the emperor Henry IV. and Pope Alexander II. The latter declared Harold a perjured uſurper; denounced excommunication againſt him and his adherents; and the more to encourage William in his enterpriſes, ſent him a conſecrated banner, and a ring with one of St Peter's hairs in it. Thus he was enabled to aſſemble a fleet of 3000 veſſels, on board of which were embarked 60,000 men, choſen from among thoſe numerous ſupplies which were ſent him from all quarters. Many eminent perſonages were enliſted under

England. der his banners. The moſt celebrated were Euſtace count of Boulogne, Aimeri de Thouars, Hugh d'Eſtaples, William d'Evreux, Geoffroy de Rotrou, Roger de Beaumont, William de Warenne, Roger de Montgomeri, Hugh de Grantmeſnil, Charles Martel, and Geoffroy Gifford.

In order to embarraſs the affairs of Harold the more effectually, William alſo excited Toſti, in concert with Halfager king of Norway, to infeſt the Engliſh coaſts. Theſe two having collected a fleet of 350 ſhips, ſailed up the Humber, and diſembarked their troops, who began to commit great depredations. They were oppoſed by
85 Morcar earl or duke (B) of Northumberland, and Ed-
Defeats the Danes. win earl of Mercia, who were defeated. Harold, on the news of this invaſion, aſſembled a conſiderable army, engaged the enemy at Standford, and after a bloody battle entirely defeated them. Toſti and Halfager were killed in the action, and all the fleet fell into the hands of the victors; but Harold generouſly allowed Olave the ſon of Halfager to depart with 20 veſſels.

The king of England had ſcarce time to rejoice on account of his victory, when news were brought him that the Normans were landed in Suſſex. Harold's victory had conſiderably weakened his army. He loſt many of his braveſt officers and ſoldiers in the action; and he diſguſted the reſt, by refuſing to diſtribute the Daniſh ſpoils among them. He haſtened, however, by quick marches, to repel this new invader; but though he was reinforced at London and other places with freſh troops, he found himſelf weakened by the deſertion of his old ſoldiers, who, from fatigue and diſcontent, ſecretly withdrew from their colours. Gurth, the brother of Harold, a man of great conduct as well as bravery, became apprehenſive of the event; and entreated the king to avoid a general engagement for ſome time, or at leaſt not to hazard his perſon. But though this advice was in itſelf evidently proper, and enforced by all the arguments which Gurth could ſuggeſt, Harold continued deaf to every thing that could
86 be ſaid. Accordingly, on the 14th of October 1066,
Is defeated and killed by William of Normandy. the two armies engaged near Haſtings, a town of Suſſex. After a moſt obſtinate and bloody battle †, the Engliſh were entirely defeated, Harold and his two brothers killed, and William left maſter of the kingdom of England.

† See *Haſtings*.

Nothing could exceed the terror of the Engliſh upon the news of the defeat and death of Harold. As ſoon as William paſſed the Thames at Wallingford, Stigand, the primate, made ſubmiſſions to him in the name of the clergy; and before he came within ſight of London, all the chief nobility, and even Edgar Atheling himſelf, who, being the rightful heir to the
87 throne, had juſt before been declared king, came and
William the Conqueror. ſubmitted to the conqueror. William very readily accepted of the crown upon the terms that were offered him; which were, that he ſhould govern according to the eſtabliſhed cuſtoms of the country. He could indeed have made what terms he pleaſed; but, though really a conqueror, he choſe rather to be thought an elected king. For this reaſon he was crowned at Weſtminſter by the archbiſhop of York, and took the oath adminiſtered to the former kings of England; namely, that he would protect and defend the church, obſerve England. the laws of the realm, and govern the kingdom with impartiality.

88 The Engliſh hiſtorians complain of the moſt grie-The Engliſh vous oppreſſion by William and his Normans. Whe-grievously ther by his conduct the conqueror willingly gave the oppreſſed. Engliſh opportunities of rebelling againſt him, in order to have a pretence for oppreſſing them afterwards, is not eaſy to ſay; but it is certain that the beginning of his reign cannot juſtly be blamed. The firſt diſguſt againſt his government was excited among the clergy. William could not avoid the rewarding of thoſe numerous adventurers who had accompanied him in his expedition. He firſt divided the lands of the Engliſh barons who had oppoſed him, among his Norman barons; but as theſe were found inſufficient, he quartered the reſt on the rich abbeys, of which there were many in the kingdom, until ſome other opportunity of providing for them offered itſelf.

Though this laſt ſtep was highly reſented by the clergy, it gave very little offence to the laity. The whole nation, however, was ſoon after diſguſted, by ſeeing all the real power of the kingdom placed in the hands of the Normans. He diſarmed the city of London, and other places which appeared moſt warlike and populous, and quartered Norman ſoldiers wherever he dreaded an inſurrection. This was indeed acting as a conqueror, and not as an elected king; but the event ſhowed the neceſſity of ſuch precautions. The king having thus ſecured, as he imagined, England from any danger of a revolt, determined to pay a viſit to his Norman dominions. He appointed his brother Odo, biſhop of Bayeux, and William Fitz-Oſborne, regents in his abſence; and to ſecure himſelf yet farther, he reſolved to carry along with him ſuch of the Engliſh nobility as he put the leaſt confidence in.

Having taken all theſe methods to enſure the tranquillity of his new kingdom, William ſet ſail for Normandy in March 1067; but his abſence produced the moſt fatal conſequences. Diſcontents and murmurings were multiplied everywhere; ſecret conſpiracies were entered into againſt the government; hoſtilities were commenced in many places; and every thing ſeemed to threaten a ſpeedy revolution. William of Poictiers, a Norman hiſtorian, throws the blame entirely on the Engliſh. He calls them a fickle and mutinous race, while he celebrates with the higheſt encomiums the juſtice and lenity of Odo's and Fitz-Oſborne's adminiſtration. On the other hand, the Engliſh hiſtorians tell us, that theſe governors took all opportunities of oppreſſing the people, either with a view to provoke them to rebellion, or in caſe they tamely ſubmitted to their impoſitions, to grow rich by plundering them. Be this as it will, however, a ſecret conſpiracy was formed among the Engliſh for a general maſſacre of the Normans, like what had formerly been made of the Danes. This was proſecuted with ſo much animoſity, that the vaſſals of the earl Coxo put him to death becauſe he refuſed to head them in the enterpriſe. The conſpirators had already taken the reſolution, and fixed the day for their intended maſſacre, which was to be on Aſh-Wedneſday, during the time of divine ſer-

(B) Anciently theſe two titles were ſynonymous.

England. vice, when all the Normans would be unarmed as penitents, according to the diſcipline of the times. But the preſence of William diſconcerted all their ſchemes. Having got intelligence of their bloody purpoſe, he haſtened over to England. Such of the conſpirators as had been more open in their rebellion, conſulted their ſafety by flight; and this ſerved to confirm the proofs of an accuſation againſt thoſe who remained. From this time the king not only loſt all confidence in his Engliſh ſubjects, but regarded them as inveterate and irreconcileable enemies. He had already raiſed ſuch a number of fortreſſes in the country, that he no longer dreaded the tumultuous or tranſient efforts of a diſcontented multitude. He determined therefore to treat them as a conquered nation. The firſt inſtance of this treatment was his revival of the tax of Danegelt, which had been impoſed by the Daniſh conquerors, and was very odious to the people. This produced great diſcontents, and even inſurrections. The inhabitants of Exeter and Cornwall revolted; but were ſoon reduced, and obliged to implore the mercy of the conqueror. A more dangerous rebellion happened in the north; but this was alſo ſoon quaſhed, and the Engliſh became ſenſible that their deſtruction was intended. Their eaſy ſubmiſſion after the battle of Haſtings had inſpired the Normans with contempt; their commotions afterwards had rendered them objects of hatred; and they were now deprived of every expedient which could make them either regarded or beloved by their ſovereign. Many fled into foreign countries; and among the reſt Edgar Atheling himſelf, who made his eſcape to Scotland, and carried thither his two ſiſters Margaret and Chriſtina. They were well received by Malcolm, who ſoon after married Margaret the elder ſiſter, and alſo received great numbers of other exiles with the utmoſt kindneſs.

The Engliſh, though unable to make any reſiſtance openly, did not fail to gratify their reſentment againſt the Normans in a private manner. Seldom a day paſſed, but the bodies of aſſaſſinated Normans were found in the woods and highways, without any poſſibility of bringing the perpetrators to juſtice. Thus, at length, the conquerors themſelves began again to wiſh for tranquillity and ſecurity; and ſeveral of them, though entruſted with great commands, deſired to be diſmiſſed the ſervice. In order to prevent theſe deſertions, which William highly reſented, he was obliged to allure others to ſtay by the largeneſs of his bounties. The conſequences were, freſh exactions from the Engliſh, and new inſurrections on their part againſt their cruel maſters. The Norman power, however, was too well founded to be now removed, and every attempt of the Engliſh to regain their liberty ſerved only to rivet their chains the more firmly. The county of Northumberland, which had been moſt active in theſe inſurrections, now ſuffered moſt ſeverely. The whole of it was laid waſte, the houſes were burned, the inſtruments of agriculture deſtroyed, and the inhabitants forced to ſeek new places of abode. On this occaſion it is ſaid that above 100,000 perſons periſhed either by the ſword or famine; and the country is ſuppoſed, even to this day, to retain the marks of its ancient depopulation. The eſtates of all the Engliſh gentry were next confiſcated, and beſtowed on the Normans. By this means all the ancient and honourable families were reduced to beggary; and the Engliſh found themſelves totally excluded from every road that led either to honour or preferment. England.

By proceeding in this manner, William at laſt broke the ſpirit of the Engliſh nation, and received no farther trouble from them. In 1076, however, he found that the latter part of his life was likely to be unhappy through diſſenſions in his own family. He had four ſons, Robert, Richard, William, and Henry, beſides ſeveral daughters. Robert, his eldeſt ſon, ſurnamed *Curthoſe*, from the ſhortneſs of his legs, was a prince who inherited all the bravery and ambition of his family. He had formerly been promiſed by his father the government of the province of Maine in France, and was alſo declared ſucceſſor to the dukedom of Normandy. He demanded from his father the fulfilment of theſe promiſes; but William gave him a flat denial, obſerving, that "it was not his cuſtom to throw off his clothes till he went to bed." Robert declared his reſentment; and openly expreſſed his jealouſy of his two brothers William and Henry, (for Richard was killed, in hunting, by a ſtag). An open rupture was ſoon commenced. The two young princes one day took it into their heads to throw water on their elder brother as he paſſed through the court after leaving their apartment. Robert conſtrued this frolic into a ſtudied indignity; and having theſe jealouſies ſtill farther inflamed by one of his favourites, he drew his ſword, and ran up ſtairs with an intent to take revenge. The whole caſtle was quickly filled with tumult, and it was not without ſome difficulty that the king himſelf was able to appeaſe it. But he could not allay the animoſity which from that moment prevailed in his family. Robert, attended by ſeveral of his confederates, withdrew to Rouen that very night, hoping to ſurpriſe the caſtle; but his deſign was defeated by the governor. The popular character of the prince, however, engaged all the young nobility of Normandy, as well as of Anjou and Britanny, to eſpouſe his quarrel; even his mother is ſuppoſed to have ſupported him in his rebellion by ſecret remittances. The unnatural conteſt continued for ſeveral years; and William was at laſt obliged to have recourſe to England for ſupport againſt his own ſon. Accordingly, he drew an army of Engliſhmen together; he led them over to Normandy, where he ſoon compelled Robert and his adherents to quit the field, and was quickly reinſtated in all his dominions. Robert then took ſhelter in the caſtle of Gerberoy, which the king of France had provided for him, where he was ſhortly after beſieged by his father. As the garriſon was ſtrong, and conſcious of their treaſon, they made a gallant defence; and many ſkirmiſhes and duels were fought under its walls. In one of theſe the king and his ſon happened to meet; but being both concealed by their helmets, they attacked each other with mutual fury. The young prince wounded his father in the arm, and threw him from his horſe. The next blow would probably have put an end to his life, had he not called for aſſiſtance. Robert inſtantly recollected his father's voice, leaped from his horſe, and raiſed him from the ground. He proſtrated himſelf in his preſence, aſked pardon for his offences, and promiſed for the future a ſtrict adherence to his duty. The king was not ſo eaſily appeaſed; and perhaps his reſentment was heightened by

89 Diſſenſions in William's family.

England. by the disgrace of being overcome. He therefore gave his malediction to his son; and returned to his own camp on Robert's horse, which he had assisted him to mount. After some recollection, however, he was reconciled to Robert, and carried him with him into England.

William returned in 1081; and being now freed from his enemies both at home and abroad, began to have more leisure to attend to his own domestic affairs. For this purpose the *Doomsday-Book* was composed by his order, of which an account is given under that article. He reserved a very ample revenue for the crown; and in the general distribution of land among his followers, kept possession of no fewer than 1400 manors in different parts of the country. No king of England was ever so opulent; none was able to support the splendor and magnificence of a court to such a degree; none had so many places of trust and profit to bestow; and consequently none ever had such implicit obedience paid to his commands. He delighted greatly in hunting; and to indulge himself in this with the greater freedom, he depopulated the county of Hampshire for 30 miles, turning out the inhabitants, destroying all the villages, and making the wretched outcasts no compensation for such an injury. In the time of the Saxon kings, all noblemen without distinction had a right to hunt in the royal forests; but William appropriated all these to himself, and published very severe laws to prohibit his subjects from encroaching on this part of his prerogative. The killing of a boar, a deer, or even a hare, was punished with the loss of the delinquent's eyes; at the time when the killing of a man might be atoned for by paying a moderate fine or composition.

As the king's wealth and power were so great, it may reasonably be supposed that the riches of his ministers were in proportion. Odo, bishop of Bayeux, William's brother, was become so rich, that he resolved to purchase the papacy. For this purpose, taking the opportunity of the king's absence, he equipped a vessel in the isle of Wight, on board of which he sent immense treasures, and prepared for his embarkation. He was detained, however, by contrary winds; and, in the mean time, William, being informed of his designs, resolved to prevent the exportation of so much wealth from his dominions. Returning therefore from Normandy, where he was at that time, he came to England the very instant his brother was stepping on board. He immediately ordered him to be made prisoner: but his attendants, respecting the bishop's ecclesiastical character, scrupled to execute his commands; so that the king was obliged to seize him with his own hand. Odo appealed to the Pope: but the king replied, that he did not seize him as bishop of Bayeux, but as earl of Kent; and, in that capacity, he expected, and would have, an account of his administration. He was therefore sent prisoner to Normandy; and, notwithstanding all the remonstrances and threats of Pope Gregory, was detained in custody during the remainder of William's reign.

90 Death of the queen; Soon after this, William felt a severe blow in the death of Matilda his queen; and, almost at the same time, received information of a general insurrection in Maine, the nobility of which had always been averse to his government. Upon his arrival on the continent, he found that the insurgents had been secretly assisted and excited by the king of France, who took all opportunities of lessening the Norman power, by creating dissensions among the nobles. His displeasure on this account was very much increased, by notice he received of some railleries thrown out against him by the French monarch. It seems that William, who was become corpulent, had been detained in bed some time by sickness; and Philip was heard to say, that he only lay in of a big belly. This so provoked the English monarch, that he sent him word, he would soon be up, and would, at his churching, present such a number of tapers as would set the kingdom of France in a flame. England.

To perform this promise, he levied a powerful army; and, entering the Isle of France, destroyed every thing with fire and sword. He took the town of Mante, and reduced it to ashes. But a period was soon put to the conquests and to the life of this great warrior by an accident. His horse happening to put his fore feet on some hot ashes, plunged so violently, that the rider was thrown forward, and bruised his belly on the pommel of the saddle. Being now in a bad habit of body, as well as somewhat advanced in years, he began to be apprehensive of the consequences, and ordered himself to be carried in a litter to the monastery of St Gervaise. Finding his illness increase, and being sensible of the approach of death, he discovered at last the vanity of all human grandeur; and was struck with remorse for those many cruelties and violences of which he had been guilty. He endeavoured to make compensation by presents to churches and monasteries, and gave orders for the liberation of several English noblemen. He was even prevailed upon, though not without reluctance, to release his brother Odo, against whom he was very much incensed. He left Normandy and Maine to his eldest son Robert. He wrote to Lanfranc the primate of England, desiring him to crown William king of England. To Henry he bequeathed nothing but the possessions of his mother Matilda; but foretold, that one day he would surpass both his brothers in power and opulence. He expired on the 9th September 1087, in the 63d year of his age, in the 21st of his reign over England, and 54th of that over Normandy. 91 And of the king.

92 William Rufus. William, surnamed *Rufus*, from his red hair, was in Normandy at the time of his father's illness. He no sooner received the letter for Lanfranc, than, leaving his father in the agonies of death, he set out for England; where he arrived before intelligence of the decease of the Conqueror had reached that kingdom. Being sensible that his brother Robert, as being the eldest son, had a preferable title to himself, he used the utmost dispatch in getting himself firmly established on the throne. The English were so effectually subdued, that they made no opposition; but the Norman barons were attached to Robert. This prince was brave, open, sincere, and generous; and even his predominant fault of indolence was not disagreeable to those haughty barons, who affected an almost total independence of their sovereign. The king, on the other hand, was violent, haughty, and tyrannical. A powerful conspiracy was therefore carried on against William; and Odo, bishop of Bayeux, undertook to conduct it. Many of the most powerful nobility were concerned; and

England. as the conſpirators expected to be in a ſhort time ſupported by powerful ſuccours from Normandy, they retired to their caſtles, and put themſelves in an offenſive poſture.

William, ſenſible of his danger, engaged the Engliſh on his ſide, by promiſing ſome mitigation of their hardſhips, and liberty to hunt in the royal foreſts. Robert, in the mean time, through his natural indolence, neglected to give his allies proper aſſiſtance. The conſpirators were obliged to ſubmit. Some of them were pardoned; but moſt of them confiſcated, and their eſtates beſtowed on the barons who had continued faithful to the king.

93 Proves a tyrant.

William, freed from this danger, thought no more of his promiſes to the Engliſh. He proved a greater tyrant than his father; and, after the death of Lanfranc, who had been his preceptor, and kept him within ſome bounds, he gave full ſcope to his violent and rapacious diſpoſition. Not content with oppreſſing the laity, he invaded the privileges of the church; which, in thoſe days, were held moſt ſacred. He ſeized the temporalities of all the vacant biſhoprics and abbeys, and openly put to ſale thoſe ſees and abbeys which he thought proper to diſpoſe of.

94 Attempts the conqueſt of Normandy.

Theſe proceedings occaſioned great murmurs among the eccleſiaſties, which were quickly ſpread through the nation, but the terror of William's authority preſerved the public tranquillity. In 1090, the king thought himſelf ſtrong enough to attempt the conqueſt of Normandy, which at that time was in the greateſt confuſion through the indolent and negligent adminiſtration of Robert. Several of the barons had revolted, and theſe revolts were encouraged by the king of France. Robert alſo imagined he had reaſon to fear the intrigues of his other brother Henry, whom for 3000 merks he had put in poſſeſſion of *Cottentin*, near a third part of the duchy of Normandy. He therefore threw him into priſon; but finding himſelf threatened with an invaſion from the king of England, he gave Henry his liberty, and even made uſe of his aſſiſtance in ſuppreſſing the inſurrections of his rebellious ſubjects. William, however, was no ſooner landed in Normandy, than the nobility on both ſides interpoſed, and a treaty of peace was concluded. In this treaty Henry finding his intereſts entirely neglected, retired to St Michael's Mount, a ſtrong fortreſs on the coaſt of Normandy, and infeſted the neighbourhood with his incurſions. He was beſieged by his two brothers, and obliged to capitulate in a ſhort time; after which, being deprived of all his dominions, he wandered about for ſome time with very few attendants, and often in great poverty.

The peace with Robert was of no long duration. In the interval ſome hoſtilities with Scotland ſucceeded, and theſe terminated in the death of Malcolm king of that country; after which new broils enſued with Normandy. The rapacious temper of William prompted him to encroach upon his brother's territories, and the ſame rapacity prompted him to uſe a very extraordinary expedient in order to accompliſh his deſigns. Having gone over to Normandy to ſupport his partiſans, he ordered an army of 20,000 men to be raiſed in England, and conducted to the ſea-coaſt as if they were to be immediately embarked: but when they came there, inſtead of embarking, they were forced to pay the king ten ſhillings a man; after which they were diſmiſſed to their ſeveral counties. With this money William engaged the king of France to depart from the protection of Robert; and alſo bribed many of the Norman barons to revolt. He was called from Normandy, however, by an irruption of the Welſh; and having repulſed them, he was prevented from attempting other enterpriſes by a conſpiracy of his barons. England.

95 Purchaſes the duchy for 10,000 merks.

In 1096, however, the ſuperſtition of Robert put the king of England in poſſeſſion of thoſe dominions which he had not been able to conquer by force of arms. The cruſades were now commenced, and Robert was deſirous of undertaking an expedition into the Holy Land. As money for this purpoſe was wanting, he mortgaged his dominions to his brother for 10,000 merks. The king raiſed the money by violent extortions on his ſubjects; forcing even the convents to melt their plate, in order to furniſh the quota demanded of them. He was then put in poſſeſſion of Normandy and Maine; and Robert with a magnificent train ſet out for the Holy Land.

After the death of Lanfranc, the king had retained in his own hands the revenues of Canterbury, as he had done thoſe of many other biſhoprics; but falling into a dangerous illneſs, he was ſeized with remorſe; and the clergy repreſented to him that he was in danger of eternal perdition if he did not make atonement for thoſe impieties and ſacrileges of which he had been guilty. He therefore inſtantly reſolved to ſupply the vacancy of Canterbury: he ſent for Anſelm, a Piedmonteſe by birth, abbot of Bec in Normandy, who was much celebrated for his piety and devotion. The abbot refuſed the dignity with great earneſtneſs; fell on his knees, wept, and intreated the king to change his purpoſe; and when he found him obſtinate in forcing the paſtoral ſtaff upon him, he kept his fiſt ſo hard clenched, that it required the utmoſt violence of the byſtanders to open it, and force him to receive that enſign of his ſpiritual dignity. William ſoon after recovered his health, and with it his violence and rapacity. As he now ſpared the church no more than before, a quarrel with Anſelm ſoon enſued; and this was the more dangerous to the king, on account of the great character for piety which the primate had acquired by his zeal againſt abuſes of all kinds, particularly thoſe of dreſs and ornament. 1096 His quarrel with the primate.

At this time there was a mode which prevailed not only in England, but throughout Europe, both among men and women, of giving an enormous length to their ſhoes, drawing the toe to a ſharp point, and affixing to it the figure of a bird's bill, or ſome ſuch ornament, which was turned upwards, and which was often ſuſtained by gold or ſilver chains tied to the knee. The eccleſiaſtics took exception at this ornament, which they ſaid was an attempt to belie the Scripture, where it is affirmed, that no man can add a cubit to his ſtature; and they not only declaimed againſt it with vehemence, but aſſembled ſome ſynods, in which the faſhion was abſolutely condemned. Such, however, are the contradictions in human nature, that all the influence of the clergy, which at that time was ſufficient to ſend vaſt multitudes of people into Aſia to butcher one another, was not able to prevail againſt thoſe long-pointed ſhoes. The faſhion, contrary to what hath happened to almoſt all others, maintained its ground for ſeveral centuries; and even Anſelm found his endeavours

England. deavours againſt it ineffectual. He was more ſucceſsful in decrying the long hair and curled locks then worn by the courtiers. He refuſed the aſhes on Aſh-Wedneſday to ſuch as were ſo accoutred; and his authority and eloquence had ſuch influence, that the young men univerſally abandoned that ornament, and appeared in the cropt hair recommended to them by the ſermons of the primate. For this reformation Anſelm is highly celebrated by his hiſtorian Eadmer, who was alſo his companion and ſecretary.

When William's profaneneſs returned with his health, he was engaged in almoſt perpetual conteſts with this auſtere prelate *. Theſe were pretty well ſettled, when the king, who had undertaken an expedition into Wales, required Anſelm to furniſh him with a certain number of ſoldiers. The primate regarded this as an invaſion of the rights of the church; and therefore, though he durſt not refuſe compliance, ſent the men ſo miſerably accoutred, that the king was exceedingly diſpleaſed, and threatened him with a proſecution. Anſelm demanded reſtitution of all his revenues which the king had ſeized, and appealed to the pope. The quarrel, however, ran ſo high, that the primate found it dangerous to remain in England. He deſired and obtained the king's permiſſion to retire beyond ſea. His temporalities were confiſcated immediately on his departure; but Pope Urban received him as a martyr in the cauſe of religion, and even threatened the king with ſentence of excommunication. William, however, proceeded in his projects of ambition and violence, without regarding the threats of the pope; who he knew was at that time too much engaged with the cruſades to mind any other buſineſs. Though his acquiſition of Maine and Normandy had brought him into perpetual conteſts with the haughty and turbulent barons who inhabited thoſe countries, and raiſed endleſs tumults and inſurrections; yet William ſeemed ſtill intent on extending his dominions either by purchaſe or conqueſt. William earl of Poictiers and duke of Guienne had reſolved upon an expedition to the Holy Land; and, for this purpoſe, had put himſelf at the head of a vaſt multitude, conſiſting, according to ſome hiſtorians, of 60,000 horſe, and a much greater number of foot. Like Robert of Normandy, he offered to mortgage his dominions for money ſufficient to conduct this multitude into Aſia. The king accepted his offer; and had prepared a fleet and army to take poſſeſſion of theſe dominions, when an unfortunate accident put an end to his projects and his life. He was engaged in hunting, the ſole amuſement, and indeed the principal occupation, of princes in thoſe rude times. Walter Tyrrel, a French gentleman remarkable for his ſkill in archery, attended him in this recreation, of which the new foreſt was the ſcene. William had diſmounted after a chace; and Tyrrel, impatient to ſhow his dexterity, let fly an arrow at a ſtag which ſuddenly ſtarted before him. The arrow glanced from a tree, and ſtruck the king to the heart. He inſtantly fell down dead; and Tyrrel, terrified at the accident, clapt ſpurs to his horſe, haſtened to the ſea-ſhore, and embarked for France, where he joined the cruſade that was ſetting out from that country. This happened on the 2d of Auguſt 1100, after the king had reigned 13 years, and lived about 40. His body was found in the woods by the country-people, and buried without ceremony at Wincheſter. England.

* See *Anſelm.*

97 Who leaves the kingdom.

98 Death of the king.

After the death of William, the crown of right devolved to Robert his eldeſt brother; for William had no legitimate children. But what Robert had formerly loſt by his indolence, he was again deprived of by his abſence at the holy war. Prince Henry was in the foreſt with William Rufus at the time the latter was killed. He no ſooner heard the important news, than he hurried to Wincheſter, and ſecured the royal treaſure. William de Breteuil, keeper of the treaſure, arrived almoſt the ſame inſtant, and oppoſed his pretenſions; telling him, that the treaſure belonged to his elder brother, who was now his ſovereign, and for whom he was determined to keep it. But Henry, drawing his ſword, threatened him with inſtant death if he dared to diſobey him; and others of the late king's retinue, who came every moment to Wincheſter, joining the prince's party, he was obliged to deſiſt. Henry loſt no time in fully accompliſhing his purpoſe. In leſs than three days he got himſelf crowned king of England by Maurice biſhop of London. Preſent poſſeſſion ſupplied every deficiency of title; and no one dared to appear in defence of the abſent prince.

99 Prince Henry uſurps the crown.

The beginning of King Henry's reign promiſed to be favourable to the Engliſh liberty; owing chiefly to his fear of his brother. To conciliate the affections of his ſubjects, he paſſed a charter calculated to remove many of the grievous oppreſſions which had been complained of during the reigns of his father and brother. He promiſed, that at the death of any abbot or biſhop, he never would ſeize the revenues of the ſee or abbey during the vacancy, but would leave the whole to be reaped by the ſucceſſor; and that he would never let to farm any eccleſiaſtical benefice, or diſpoſe of it for money. To the laity he promiſed, that, upon the death of any earl, baron, or military tenant, his heir ſhould be admitted to the poſſeſſion of his eſtate, on paying a juſt and lawful relief; without being expoſed to thoſe enormous exactions which had been formerly required. He remitted the wardſhip of minors; and allowed guardians to be appointed, who ſhould be anſwerable for the truſt. He promiſed not to diſpoſe of any heireſs in marriage but by advice of all the barons; and if any baron intended to give his daughter, ſiſter, niece, or kinſwoman in marriage, it ſhould only be neceſſary for him to conſult the king, who promiſed to take no money for his conſent, nor ever to refuſe permiſſion, unleſs the perſon to whom it was propoſed to marry her ſhould happen to be his enemy. He granted his barons and military tenants the power of bequeathing by will their money or perſonal eſtates; and if they neglected to make a will, he promiſed that their heirs ſhould ſucceed to them. He renounced the right of impoſing moneyage, and of levying taxes at pleaſure, on the farms which the barons kept in their own hands. He made ſome general profeſſions of moderating fines; he offered a pardon for all offences; and remitted all debts due to the crown. He alſo required, that the vaſſals of the barons ſhould enjoy the ſame privileges which he granted to his own barons; and he promiſed a general confirmation and obſervance of the *laws of King Edward* *. To give greater authenticity to theſe conceſſions, a

100 His charter in favour of the people.

* See *Feodal* Syſtem.

copy

England. copy of the charter was lodged in some abbey of each county.

King Henry, farther to increase his popularity, degraded and committed to prison Ralph Flambard bishop of Durham, who had been the chief instrument of oppression under his brother. He sent for Anselm who was then at Lyons, inviting him to return and take possession of his dignities. Anselm returned; but when Henry proposed to him to do the same homage to him which he had done to his brother, the king met with an absolute refusal. During his exile, Anselm had assisted at the council of Bari; where, besides fixing the controversy between the Greek and Latin churches concerning the procession of the Holy Ghost, the right of election to church-preferments was declared to belong to the clergy alone, and spiritual censures were denounced against all ecclesiastics who did homage to laymen for their fees and benefices, and on all laymen who exacted it. The rite of homage † by the feudal customs was, that the vassal should throw himself on his knees, put his joined hands between those of his superior, and should in that posture swear fealty to him. But the council declared it execrable, that pure hands, which could create God, and offer him up for the salvation of mankind, should be put, after this humiliating manner, between profane hands, which, besides being inured to rapine and bloodshed, were employed day and night in impure purposes and obscene contacts. To this decree therefore Anselm appealed; and declared, that so far from doing homage for his spiritual dignity, he would not even communicate with any ecclesiastic who paid that submission, or who accepted of investitures from laymen. Henry durst not insist; and therefore desired that the controversy might be suspended, and that messengers might be sent to Rome to accommodate matters with the Pope, and to obtain his confirmation of the laws and customs of England.

101 Quarrels with the primate.

† See Feodal *Tenure*.

Henry now took another step which seemed capable of confirming his claims to the crown without any danger of a rival. The English remembered with regret their Saxon monarchs, when they compared the liberty they enjoyed under them with the tyranny of the Normans. Some descendants of that favourite line still remained; and among the rest, Matilda, the niece of Edgar Atheling. Upon her the king fixed his eyes as a proper consort, by whose means the breach between the Saxons and Normans might be cemented. A difficulty, however, occurred, because she had been educated in a nunnery. The affair was examined by Anselm in a council of prelates and nobles summoned at Lambeth. Matilda there proved, that she had put on the veil, not with a design of entering into a religious life, but merely in imitation of a custom familiar to the English ladies, who protected their chastity from the brutal violence of the Normans by taking shelter under that habit, which amid the horrid licentiousness of the times was yet generally revered. The council, sensible that even a princess had otherwise no security for her honour, admitted this reason as valid. They pronounced that Matilda was still free to marry; and her nuptials with Henry were celebrated by Anselm with great solemnity and pomp.

102 He marries Matilda.

While Henry was thus rendering himself popular at home, his brother Robert, who had loitered away a twelvemonth in Italy, where he married Sibylla daughter of the count of Conversana, arrived in England, in 1101, in order to put in his late and ineffectual claim to the crown. His fame, however, on account of the exploits he had performed in Palestine, was so great, that even yet he was joined by many noblemen of the first rank, and the whole nation seemed prepossessed in his favour. But Henry, having paid his court to Anselm, by his means retained the army in his interests, and marched with them to Portsmouth, where Robert had landed his forces a few days before. The armies lay for some time in sight of each other; when an accommodation was effected through the mediation of Anselm and other great men. By this treaty it was agreed, that Robert should resign his pretensions to England, and receive in lieu of them an annual pension of 3000 marks; that if either of the princes died without issue, the other should succeed to his dominions; that the adherents of each should be pardoned, and restored to all their possessions either in Normandy or England; and that neither Robert nor Henry should thenceforth encourage, receive, or protect the enemies of each other.

England. 103 Crown of England claimed by Robert.

The two princes separated with mutual marks of friendship; but next year, Henry, under various pretences, confiscated the estates of almost all the noblemen who had favoured his brother's pretensions. Robert, enraged at the fate of his friends, ventured to come to England in order to remonstrate with his brother in person. But he met with such a bad reception, that, apprehending his liberty to be in danger, he was glad to make his escape by resigning his pension.

This infringement of the treaty was followed the ensuing year by an invasion of Normandy, at the desire of Robert's own subjects, whom he was totally incapable of governing *. The event of this war was the defeat and captivity of Robert, who was henceforth deprived not only of all his dominions, but of his personal liberty. He lived 28 years a prisoner, and died in the castle of Cardiff in Glamorganshire. It is even said by some, that he was deprived of his sight by a red-hot copper bason applied to his eyes, and that King Henry appeased his conscience by founding the monastery of Reading.

104 Normandy invaded by Henry.

* See *Normandy*.

The conquest of Normandy was completed in 1106; and next year the controversy between the king and primate, concerning the investitures of clergymen and their doing homage to princes, was resumed. The king was very sensible that it was not his interest to quarrel with such a powerful body as the clergy were at that time; and on the other hand, he fully understood the necessity of guarding the prerogatives of the crown from their encroachments. While, therefore, he avoided an open rupture with Anselm, he obstinately refused to give up the privileges which had been enjoyed by his predecessors. On the first arrival of Anselm, the king had avoided the dispute in the manner already mentioned. A messenger was dispatched to Rome, in order to compromise matters with the pope. The messenger returned with an absolute refusal of the king's demands. One of the reasons given by the pope on this occasion was expressed in the following words: "It is monstrous that a son should pretend to beget his father, or a man to create his God: priests are called

105 Quarrels with the primate.

England. called *gods* in ſcripture, as being the vicars of God: and will you, by your abominable pretenſions to grant them their inveſtiture, aſſume the right of creating them?" Henry was not yet convinced; but as he was determined to avoid, or at leaſt to delay, the coming to any dangerous extremity with the church, he perſuaded Anſelm, that by farther negotiation he ſhould be able to compound matters with the pope. Meſſengers were therefore diſpatched to Rome a ſecond time from the king; and alſo from Anſelm, who wanted to be fully aſſured of the pope's intentions. They returned with letters wrote in the moſt arrogant and poſitive manner, both to the king and primate. The king ſuppreſſed the letter ſent to himſelf; and perſuaded the three biſhops, by whom it was ſent, to aſſert, upon their epiſcopal faith, that the pope had aſſured them of his private good intentions towards King Henry, and of his reſolution not to reſent any future exertion of his prerogative in granting inveſtitures; though he himſelf ſcrupled to give this aſſurance under his hand, leſt other princes ſhould copy the example and aſſume a like privilege. Anſelm's two meſſengers, who were monks, affirmed that it was impoſſible this ſtory could have any foundation; but their word was not deemed equivalent to that of three biſhops; and the king, as if he had finally gained his cauſe, proceeded to fill the ſees of Hereford and Saliſbury, and to inveſt the new biſhops in the uſual manner. Anſelm, however, gave no credit to the aſſertions of the king's meſſengers; and therefore refuſed not only to conſecrate them, but even to communicate with them; and the biſhops themſelves, finding they were become univerſally odious, returned the enſigns of their ſpiritual dignity.

The quarrel continued between the king and primate, till the latter, ſenſible of his dangerous ſituation, deſired leave to make a journey to Rome, in order to lay the caſe before the pope. This permiſſion was eaſily obtained; but no ſooner was the primate gone, than Henry confiſcated all his revenues, and ſent another meſſenger to negociate with the pope. The new meſſenger told his holineſs, that his maſter would ſooner part with his crown than the right of granting inveſtitures. "And I (replied the pope) would rather loſe my head than allow him to retain it." This quarrel now became very dangerous to the king; as he was threatened by the pope with excommunication, which would have been attended with terrible conſequences. At laſt, however, a compromiſe was made in the following manner. Before biſhops took poſſeſſion of their dignities, they had formerly been accuſtomed to paſs through two ceremonials: They received, from the hands of the ſovereign, a ring and croſier as the ſymbols of their office, and this was called their *inveſtiture*: they alſo made thoſe ſubmiſſions to the prince, which were required of the vaſſals by the rites of the feudal law, and which received the name of *homage*. The pope, therefore, was for the preſent contented with Henry's reſigning his right of granting inveſtitures, by which the ſpiritual dignity was ſuppoſed to be conferred; and he allowed the biſhops to do homage for their temporal properties and privileges. After this, the pope allowed Anſelm to communicate with the prelates who had already received inveſtitures from the crown; and he only required of them ſome ſubmiſſions for their paſt conduct. He alſo granted to Anſelm a plenary power of remedying every diſorder, which he ſaid might ariſe from the barbarouſneſs of the country. About the ſame time the marriage of prieſts was prohibited; and even laymen were not allowed to marry within the ſeventh degree of affinity. By this contrivance the pope augmented the profits which he reaped from granting diſpenſations, and likewiſe thoſe from divorces. For as the art of writing was then rare, and pariſh-regiſters were not regularly kept, it was not eaſy to aſcertain the degrees of affinity even among people of rank; and any man who had money to pay for it, might obtain a divorce, on pretence that his wife was more nearly related to him than was permitted by the canons. A decree was alſo publiſhed, prohibiting the clergy to wear long hair; and the king, though he would not reſign his prerogatives to the church, very willingly cut his hair in the form which was required of him, obliging all the courtiers at the ſame time to follow his example. England.

From the time of this compromiſe, which happened in 1107, to the year 1120, nothing remarkable happened except ſome ſlight commotions in Normandy: but this year, Prince William, the king's only ſon, was unfortunately drowned off the coaſt of Normandy; and Henry was ſo much affected, that he is ſaid never afterwards to have ſmiled or recovered his wonted cheerfulneſs. It is very doubtful, however, whether the death of this prince was not an advantage to the Britiſh nation, ſince he was often heard to expreſs the utmoſt hatred to the natives; inſomuch that he had threatened, that when he came to the throne, he would make them draw the plough, and would turn them into beaſts of burden. Theſe prepoſſeſſions he inherited from his father; who, though he was wont, when it might ſerve his purpoſes, to value himſelf on his birth as a native of England, ſhowed, in the courſe of his government, an extreme prejudice againſt that people. All hopes of preferment to eccleſiaſtical as well as civil dignities were denied to the Engliſh during this whole reign; and any foreigner, however ignorant or worthleſs, was ſure to have the preference in every competition. The charter formerly mentioned, which the king granted at the beginning of his reign, was no more thought of; and the whole fell ſo much into neglect and oblivion, that in the following century, when the barons, who had heard an obſcure tradition of it, deſired to make it the model of the great charter which they exacted from King John, they could only find one copy of it in the whole kingdom; while the grievances, propoſed to be redreſſed by it, continued ſtill in their full extent. 126 Prince William drowned.

As Henry had now no legitimate children except Matilda, whom in 1110 he had betrothed, though only eight years of age, to the emperor of Germany, he was induced to marry a ſecond time in hopes of having ſons. He made his addreſſes accordingly to Adelais the daughter of Godfrey duke of Lovaine, and niece to Pope Calixtus; a young princeſs of an amiable perſon. But Adelais brought him no children: and in 1135, the king died in Normandy, from eating too plentifully of lampreys; having lived 67 years, and reigned 35. 127 Death of King Henry.

By the will of King Henry, his daughter Matilda became heireſs of all his dominions. She had been

England. married, after her firſt huſband's death, to Geoffrey Plantagenet, eldeſt ſon of the count of Anjou, by whom ſhe had a ſon named *Henry;* but as Geoffrey had given umbrage to the king of England in ſeveral inſtances, no notice was taken of him in the will. The nobility had already ſworn fealty to her; and the foremoſt to ſhow this mark of ſubmiſſion to the king's will had been Stephen, ſon of the count of Blois (who had married Adela the daughter of William the Conqueror). He had been married to Matilda, daughter and heireſs of Euſtace count of Boulogne; who brought him, beſides that feudal ſovereignty of France, a vaſt property in England, which in the diſtribution of lands had been conferred by the Conqueror on the family of Boulogne. By this marriage Stephen acquired a new connection with the royal family of England: for Mary, his wife's mother, was ſiſter to David the preſent king of Scotland, and to Matilda the firſt wife of Henry and mother of the empreſs. The king alſo, imagining that by the aggrandizement of Stephen he ſtrengthened the intereſt of his own family, had enriched him with many poſſeſſions; but inſtead of this, it appeared by the event that he had only put it more and more in his power to uſurp the throne.

108 Stephen uſurps the throne.

No ſooner was Henry dead, than Stephen haſtened from Normandy into England. The citizens of Dover and Canterbury, appriſed of his purpoſe, ſhut their gates againſt him; but when he arrived at London, ſome of the lower claſs of people, inſtigated by his emiſſaries, immediately proclaimed him king. The archbiſhop of Canterbury refuſed to give him the royal unction; but this difficulty was got over by Stephen's brother, the biſhop of Wincheſter. Hugh Bigod, ſteward of the houſehold, made oath before the primate, that the late king, on his death-bed, had diſcovered a diſſatisfaction with his daughter Matilda, and had expreſſed his intention of leaving the count of Boulogne heir to all his dominions; and the biſhop either believing, or pretending to believe, this teſtimony, gave Stephen the royal unction. Very few of the nobility attended his coronation; but none oppoſed his uſurpation, however unjuſt or flagrant.

Stephen, in order to eſtabliſh himſelf on the throne as firmly as poſſible, paſſed a charter, in which he made liberal promiſes to all ranks of men. To the clergy he promiſed, that he would ſpeedily fill all the vacant benefices, and never would levy any of the rents during the vacancy. To the nobility he gave liberty to hunt in their own foreſts; and to the people he promiſed to remit the tax of danegelt, and to reſtore the laws of Edward the Confeſſor. He ſeized the king's treaſure at Wincheſter, amounting to 100,000l.; with part of which money he hired mercenary ſoldiers from the continent; and with another part procured a bull from the pope, confirming his title to the Engliſh throne.

Matilda, in the mean time, endeavoured to recover her juſt rights, of which Stephen had deprived her; but for ſome time ſhe met with no ſucceſs either in England or Normandy. Her huſband Geoffrey himſelf was obliged to conclude a peace with Stephen, on condition of the king's paying him during that time an annual penſion of 5000l.

Robert earl of Glouceſter was the firſt who ſhook the power of Stephen. He was natural ſon to the late king; a man of great honour and ability, and was very much attached to the intereſts of Matilda. When Stephen uſurped the throne, he offered to do him homage, and take the oath of fealty; but with an expreſs condition, that the king ſhould maintain all his ſtipulations, and never invade any of Robert's rights or dignities. With this condition Stephen was obliged to comply, on account of the great power of that nobleman, though he knew that it was meant only to afford him a favourable opportunity of revolting when occaſion ſerved. The clergy imitated Robert's example; and annexed to their oath of allegiance the following condition, namely; that they were only bound as long as the king defended the eccleſiaſtical liberties, and ſupported the diſcipline of the church. The barons, in return for their ſubmiſſion, exacted terms of ſtill more pernicious tendency. Many of them required to have the right of fortifying their caſtles, and putting themſelves in a poſture of defence; and with this exorbitant demand the king was forced to comply. All England was immediately filled with theſe fortreſſes; which the noblemen garriſoned either with their vaſſals, or with licentious ſoldiers, who flocked to them from all quarters. The whole kingdom now became a ſcene of rapine and devaſtation. Wars were carried on by the nobles in every quarter; the barons even aſſumed the right of coining money, and of exerciſing, without appeal, every act of juriſdiction; and the inferior gentry, as well as the people, finding no defence from the laws, during this total diſſolution of ſovereign authority, were obliged, for their immediate ſafety, to pay court to ſome neighbouring chieftain, and to purchaſe his protection, both by ſubmitting to his exactions, and by aſſiſting him in his rapine upon others.

England. 109 Diſtracted ſtate of the kingdom.

In 1137, the earl of Glouceſter having projected an inſurrection, retired beyond ſea, ſent the king a defiance, and ſolemnly renounced his allegiance. The next year David king of Scotland appeared with an army in defence of his niece's title; and penetrating into Yorkſhire, committed the greateſt devaſtations. He was defeated, however, with great ſlaughter, at Northallerton, by ſome of the northern barons, who had raiſed a powerful army; and this ſucceſs ſo much overawed the malecontents in England, that Stephen's power might have received ſome ſtability, had he not unfortunately engaged himſelf in a conteſt with the clergy. He had already ſeen the miſchief ariſing from the liberty he had granted of fortifying ſo many caſtles in different parts of the kingdom. He therefore determined to abridge this liberty as much as poſſible; and for that purpoſe he began with the caſtles erected by the clergy, who ſeemed to have leſs right to theſe military ſecurities than the barons. Taking advantage therefore of a fray which had ariſen at court between the retinue of the biſhop of Saliſbury and the earl of Britanny, he ſeized the biſhops both of Saliſbury and Lincoln, threw them into priſon, and obliged them to deliver up the caſtles which they had lately erected. This produced ſuch a violent commotion, that the opportunity ſeemed favourable to the pretenſions of Matilda. On the 22d of September 1139, ſhe landed in England with Robert earl of Glouceſter, attended only by 140 knights; but her partizans daily increaſed, and ſhe was ſoon in a condition to face

110 Matilda lands in England.

Stephen

England. Stephen with equal forces in the field. Numberleſs encounters happened, the detail of which could afford very little entertainment to the reader. War was ſpread through every quarter; and the turbulent barons having, in a great meaſure, ſhaken off all reſtraint of government, and now obtained the ſanction of fighting in the cauſe of their country, redoubled their oppreſſions, tyrannies, and devaſtations. The caſtles of the nobility became receptacles of licenſed robbers; who, ſallying forth day and night, ſpoiled the open country, plundered the villages, and even cities. They tortured the captives to make them reveal their treaſures, ſold their perſons to ſlavery; and ſet fire to the houſes, after they had pillaged them of every thing valuable. In conſequence of this deſtruction, the land was left untilled; the inſtruments of huſbandry were abandoned; and a grievous famine reduced the nation to the moſt deplorable ſtate that can be imagined.

111 Stephen defeated and taken priſoner. After a multitude of indeciſive conflicts, a battle enſued which ſeemed likely to enſure the public peace for ſome time. Stephen had marched his forces to relieve the city of Lincoln; the earl of Glouceſter led a body of troops to aſſiſt thoſe of Matilda's party, who were beſieging that place. The two armies engaged on the 2d of February within ſight of the city, and a deſperate battle enſued. At laſt Stephen's army was defeated. He himſelf was for ſome time left without attendants; and fought on foot in the midſt of his enemies, aſſaulted by multitudes, and reſiſting all their efforts with aſtoniſhing intrepidity. Being hemmed in on every ſide, he forced a way for ſome time with his battle-axe; but that breaking, he drew his ſword, and with it furiouſly aſſailed his antagoniſts for ſome time longer. But at length the ſword alſo flying in pieces, he was obliged to ſurrender himſelf a priſoner. He was conducted to Glouceſter; and though at firſt treated with reſpect, he was in a ſhort time, upon ſome ſuſpicions, thrown into irons.

112 Matilda crowned. About a month after, Matilda was crowned at Winchester with great ſolemnity; but ſoon ſhowed herſelf totally incapable of governing ſuch a turbulent nation. She determined to repreſs the power of the nobles, who had now left only the ſhadow of authority to their ſovereign. But being deſtitute of policy or prudence ſufficient to accompliſh ſo difficult an undertaking, a conſpiracy was ſoon formed againſt her, and the biſhop of Wincheſter detached a party of his friends and vaſſals to block up the city of London where the queen reſided. At the ſame time meaſures were taken to inſtigate the Londoners to a revolt, and to ſeize the queen's perſon. Matilda, having timely notice of this conſpiracy, fled to Wincheſter. Here ſhe was ſoon after beſieged by the biſhop: but the town being diſtreſſed by famine, ſhe with difficulty made her eſcape; while her brother the earl of Glouceſter, endeavouring to follow, was taken priſoner, and exchanged for Stephen.

113 Stephen reſtored. Matilda was now obliged to take ſhelter in Oxford, while Stephen reaſcended the throne. The civil war broke out with redoubled fury. Many battles were fought, and both parties were involved in many diſtreſſes. Matilda eſcaped from Oxford at a time when the fields were covered with ſnow, by being dreſſed all in white, with four knights her attendants dreſſed in the ſame colour. Another time Stephen was ſurpriſed by the earl of Glouceſter at Wilton, and made his eſcape with the utmoſt difficulty. At laſt Matilda was obliged to quit the kingdom; and the death of the earl of Glouceſter ſoon after ſeemed to give a fatal blow to her intereſts. In 1153, however, Prince Henry, Matilda's ſon by her ſecond huſband Geoffrey, came over to England, in order once more to diſpute Stephen's pretenſions to the crown. After ſome ſucceſs on his firſt landing, he was oppoſed by Stephen with a powerful army, and matters ſeemed likely to come to the deciſion of a general engagement. But while the two armies continued within a quarter of a mile of each other, a treaty was ſet on foot by the interpoſition of William earl of Arundel, for terminating the diſpute in an amicable manner. The death of Euſtace, Stephen's ſon, whom he had deſigned for the throne, which happened during the courſe of the treaty, facilitated its concluſion. It was agreed, that Stephen ſhould reign during his life, and that juſtice ſhould be adminiſtered in his name; that Henry, on Stephen's death, ſhould ſucceed to the kingdom; and that William, Stephen's ſon, ſhould inherit Boulogne and his patrimonial eſtate. This treaty filled all Europe with joy; and after the barons had ſworn to it, Henry left England, and Stephen returned to the peaceable enjoyment of his throne. His reign, however, was but of ſhort continuance; his death happening on the 25th of October 1154. 114 His death.

Henry was on the continent beſieging a caſtle of one of the mutinous barons, when news was brought him of Stephen's death. But, as he was ſenſible of the goodneſs of his title, he did not abandon his enterpriſe till the place was reduced. He then ſet out on his journey, and was received in England with the utmoſt joy. 115 Henry II. The firſt acts of his reign ſeemed to promiſe a happy and proſperous adminiſtration. He inſtantly diſmiſſed the mercenary ſoldiers who had committed the greateſt diſorders throughout the nation. He ordered all the caſtles which had been erected ſince the death of Henry I. to be demoliſhed, except a few which he retained in his own hands for the protection of the kingdom. The adulterated coin which had been ſtruck during the reign of Stephen was cried down, and new money ſtruck of the right value and ſtandard. He reſumed many of thoſe benefactions which had been made to churches and monaſteries in the former reigns. He gave charters to ſeveral towns, by which the citizens claimed their freedom and privileges independent of any ſuperior but himſelf. Theſe charters were the ground-work of the Engliſh liberty; for thus a new order, namely, the more opulent of the people, began to claim a ſhare in the adminiſtration, as well as the nobility and clergy. Thus the feudal government was at firſt impaired; and liberty began to be more equally diffuſed throughout the nation.

Henry II. on his acceſſion to the Engliſh throne, found himſelf poſſeſſed of very extenſive dominions on the continent. In the right of his father, he poſſeſſed Anjou, Touraine, and Maine; in that of his mother, Normandy; in that of his wife, Guienne, Poictou, Xaintonge, Auvergne, Perigord, Angoumois, and the Limouſin. Soon after, he annexed Britanny to his other ſtates, by marrying his ſon, who was yet a child, to the heireſs of Britanny, who was a child

England. also, and was already in poſſeſſion of the ſuperiority over that province. Theſe territories compoſed above a third of the French monarchy, and were by far the moſt opulent part of it; ſo that Henry, though vaſſal to the king of France, was greatly ſuperior to him in power; and when England was added to all theſe, the French king had great reaſon to apprehend ſome diſaſter to himſelf and family. The king of England, however, reſided at too great a diſtance to be able to employ this formidable power with ſucceſs againſt the French monarch. He ſoon became a kind of ſtranger in his continental dominions; and his ſubjects there conſidered their allegiance as more naturally due to their ſuperior lord, who lived in their neighbourhood, and who was acknowledged to be the ſupreme head of their nation. Their immediate lord was often at too great a diſtance to protect them; and a commotion in any part of Henry's extenſive dominions gave great advantages againſt him. The wiſe and vigorous adminiſtration of Henry, however, counterbalanced in a great meaſure theſe diſadvantages; and he maintained a ſurpriſing tranquillity throughout his extenſive dominions during the greateſt part of his reign.

Henry found no great difficulty in circumſcribing the power of the barons; but when he attempted to do the ſame thing with the clergy, he met with the moſt violent oppoſition. That body had carried their independence on the civil power ſo far, that now they ſeemed to aim at nothing leſs than a liberty to commit all manner of crimes with impunity. During the reign of Stephen, they had extorted an immunity from all but eccleſiaſtical penalties*; and that grant they were reſolved to maintain for the future. It may eaſily be ſuppoſed, that a law which thus ſcreened their wickedneſs, contributed to increaſe it; and we accordingly find upon record, not leſs than 100 murders committed by men in holy orders, in the ſhort period ſince the king's acceſſion, not one of which was puniſhed even with degradation, while the biſhops themſelves ſeemed to glory in this horrid indulgence. The king did not make any attempts againſt them during the life of Theobald archbiſhop of Canterbury, who was a man of a mild character, and beſides had great merit; becauſe, during the former reign, he had refuſed to put the crown on the head of Euſtace, Stephen's ſon. He died in 1162; and the king, after his death, advanced to the ſee of Canterbury Thomas à Becket, his chancellor, on whoſe compliance he thought he might entirely depend.

* See (Benefit of) *Clergy*.

116 Monſtrous wickedneſs of the clergy.

117 Conteſts of the king with Thomas à Becket.

The new archbiſhop was the firſt man of Engliſh pedigree, who, ſince the Norman conqueſt, had riſen to any conſiderable ſtation. Before his inſtalment in the ſee of Canterbury, Becket had been exceedingly complaiſant, good-humoured, and agreeable to his maſter; and had alſo been accuſtomed to live very freely. But no ſooner was he inveſted with this high dignity, than he totally altered his conduct, and put on all thoſe airs of affected and oſtentatious humility which could recommend him to the ſuperſtitious and ignorant multitude in that age. The firſt ſtep taken by this hypocrite after his advancement, was to reſign the office of chancellor. This he did without conſulting the king: the reaſon he gave was, that henceforth he muſt detach himſelf from ſecular affairs, and be ſolely employed in the duties of his ſacred function; but in reality, that he might break off all connection with Henry. As he knew that the king intended to abridge the eccleſiaſtical power, he thought the beſt method would be to become himſelf the aggreſſor. He therefore ſummoned the earl of Clare to ſurrender the barony of Tunbridge: which, ever ſince the Conqueſt, had remained in the family of that nobleman; but which, as it had formerly belonged to the ſee of Canterbury, the primate pretended that his predeceſſors were prohibited by the canons from alienating.—William de Eynsford, a military tenant of the crown, was patron of a living which belonged to a manor that held of the archbiſhop of Canterbury; and Becket, without regard to William's right, preſented, on a new and illegal pretence, one Laurence to that living, who was violently expelled by Eynsford. Upon this Eynsford was excommunicated. He complained to the king, that he, who held *in capite* of the crown, ſhould, contrary to the practice eſtabliſhed by the Conqueror and maintained ever ſince by his ſucceſſors, be ſubjected to that terrible ſentence, without the previous conſent of the ſovereign. Henry, by a meſſenger, commanded Becket to abſolve Eynsford. The haughty primate anſwered, that it belonged not to the king to inform him whom he ſhould abſolve, and whom excommunicate; but, after all, he was obliged to comply with the king's orders, though with the worſt grace imaginable. England.

As Henry perceived that the crown was now in danger, through the ſuperſtition of the people, of falling totally under the power of the clergy, he reſolved to exert himſelf to the utmoſt againſt their ſcandalous uſurpations. Among their other inventions to obtain money, they had now inculcated the neceſſity of penance as an atonement for ſin; and having again introduced the practice of paying them large ſums as an equivalent for theſe penances, the ſins of the people had thus become a revenue to the prieſts; and the king computed, that, by this invention alone, they levied more money from his ſubjects than what flowed by all the funds and taxes into the royal exchequer. To eaſe the people of ſo heavy and arbitrary an impoſition, the king required, that a civil officer of his appointment ſhould be preſent in all eccleſiaſtical courts, and ſhould for the future give his conſent to every compoſition made for ſpiritual offences. About this time alſo the king had an opportunity of proceeding againſt the clergy on another footing. A clerk in Worceſterſhire, having debauched a gentleman's daughter, murdered her father. The king required that the clerk ſhould be delivered up to the magiſtrate. Becket pleaded the privileges of the church; confined the criminal in the biſhop's priſon, leſt he ſhould be ſeized by the king's officers; and maintained that no greater puniſhment could be inflicted on him than degradation. The king then required, that, immediately after he was degraded, he ſhould be tried by the civil powers; but the primate aſſerted, that it was iniquitous to try a man twice upon the ſame accuſation, and for the ſame crime. Upon this, Henry ſummoned an aſſembly of all the prelates in England; and put to them this deciſive queſtion, Whether or not they were willing to ſubmit to the ancient laws and cuſtoms of the kingdom? The biſhops unanimouſly replied, that they were willing, *ſaving their own order*. The king was provoked

England. provoked to the laſt degree at this equivocal anſwer. He left the aſſembly with evident marks of diſpleaſure; and required the primate inſtantly to ſurrender the caſtles of Eye and Berkham. The other prelates were terrified; but Becket continued inflexible: however, he was at laſt prevailed upon, by the interpoſition of Philip the pope's legate and almoner, to retract the ſaving clauſe, and promiſe without any reſerve to obſerve the ancient cuſtoms.

The king was not now to be ſatisfied with general promiſes from the clergy: he was determined that the ancient laws and cuſtoms ſhould be defined, as well as the privileges of the clergy. He therefore ſummoned another great council of the clergy and nobility at Clarendon, to whom he ſubmitted this important affair. A number of regulations was there drawn up, which were afterwards well known by the title of the *Conſtitutions of Clarendon*. By theſe it was enacted, that clergymen accuſed of any crime ſhould be tried in the civil courts; that laymen ſhould not be tried in ſpiritual courts, except by legal and reputable witneſſes; that the king ſhould ultimately judge in eccleſiaſtical and ſpiritual appeals; that the archbiſhops and biſhops ſhould be regarded as barons, and obliged to contribute to the public expences like other perſons of their rank; that the goods forfeited to the king ſhould not be protected in churches or church-yards by the clergy; and that the ſons of villeins ſhould not take orders without the conſent of their lord. Theſe, with ſome others of leſs conſequence, to the number of 16, were ſubſcribed by all the biſhops preſent, and even by Becket himſelf; who, however, at firſt, ſhowed ſome reluctance.

Nothing now remained but to get the conſtitutions ratified by the pope; but in this the king was diſappointed. The pope rejected them with the utmoſt indignation; and, out of 16, admitted only ſix, which he thought were not important enough to deſerve cenſure.—Becket was now mortified to the higheſt degree. He retracted his conſent to the conſtitutions, redoubled his auſterities, and even refuſed to execute any part of his ſacerdotal function till he had obtained abſolution from his holineſs. Henry, conſidering theſe humilities as inſults offered to himſelf, deſired the pope to ſend him a legate. He did ſo; but annexed a clauſe to his commiſſion, by which he was prohibited from acting againſt the archbiſhop of Canterbury. The king ſent back the commiſſion to the pope; and being now exaſperated beyond all patience, commenced furious proſecutions againſt Becket. He firſt ſued him for ſome lands belonging to his primacy; and Becket being detained by ſickneſs from coming into court, his non-attendance was conſtrued into diſreſpect. The primate afterwards defended his cauſe in perſon; but all his goods and chattels were confiſcated, and the biſhop of Winchester was obliged to pronounce the ſentence. Another ſuit was commenced againſt him for 300l. which he had levied on the honours of Eye and Berkham, and the primate agreed to give ſecurities for the payment of the ſum. The next day a third ſuit was commenced againſt him for 1000 marks, which the king had lent him upon ſome former occaſion: and immediately following theſe, a ſtill greater demand was made; namely, that Becket ſhould give an account of the money he had received and expended during the time he was chancellor. The England. money was computed at no leſs than 40,000 marks; and the primate, unable either to give an account, or find ſecurities, took the following extraordinary method of evading the king's deſigns. He arrayed himſelf in his epiſcopal veſtments; and with the croſs in his hand, went forward to the palace. Having entered the royal apartments, he ſat down, holding up the croſs as his banner and protection. The king, who ſat in an inner apartment, ordered by proclamation all the prelates and nobility to attend him; to whom he loudly complained of Becket's inſolence. The whole council joined in condemning this inſtance of his unaccountable pride; and determined to expoſtulate with him about his inconſiſtency concerning the conſtitutions of Clarendon. But all their meſſages, threats, and arguments, were in vain. Becket put himſelf, in the moſt ſolemn manner, under the protection of the ſupreme pontiff, and appealed to him againſt any penalty which his iniquitous judges might think proper to inflict. Then leaving the palace, he aſked the king's immediate permiſſion to quit Northampton; but being refuſed, he ſecretly withdrew in diſguiſe, and at laſt found means to croſs over to the continent. 118 Becket flies to the continent.

Becket was received with the greateſt marks of eſteem, firſt by the king of France (who hated Henry on account of his great power), and then by the pope, whoſe cauſe he had ſo ſtrenuouſly defended in England. Henry at the ſame time ſent ambaſſadors to the pope, who were treated with coolneſs and contempt, while Becket was honoured with the greateſt marks of diſtinction. Theſe favours beſtowed upon an exile and a perjured traitor (for ſuch had been Becket's ſentence of condemnation in England), irritated the king to ſuch a degree, that he reſolved to throw off at once all dependence upon the pope. He accordingly iſſued out orders to his juſticiaries; inhibiting, under ſevere penalties, all appeals to the pope or the archbiſhop; and forbidding any of them to receive mandates from them, or to apply to their authority. He declared it treaſonable to bring over from either of them any interdict upon the kingdom. This he made punihable in ſecular clergymen by the loſs of their livings, and by caſtration; in regulars, by the amputation of their feet; and in laymen, by death. On the other hand, the pope and the archbiſhop did not fail to iſſue forth their fulminations in ſuch a manner as to ſhake the very foundation of the king's authority. Becket excommunicated by name all the king's chief miniſters who had been concerned in ſequeſtrating the revenues of his ſee, and all who obeyed or favoured the conſtitutions of Clarendon. He even threatened to excommunicate the king if he did not ſpeedily repent; and had not the pope himſelf been threatened every day with the machinations of an antipope, whoſe pretenſions he was afraid the king of England might ſupport, the ſentence of excommunication would certainly have been denounced.

At firſt, Henry paid little regard to theſe fulminations; but afterwards, when he found that his authority over his ſubjects began to decline on that account, and that his rivals on the continent were endeavouring to diſturb the tranquillity of his dominions, he began ſincerely to deſire a reconciliation. This the pope and

Becket

England. Becket alſo became deſirous of, becauſe they ſaw that their utmoſt endeavours were inſufficient to draw Henry's ſubjects into a revolt againſt him. The treaty of accommodation, however, was often broken off, through the extreme jealouſy of each of the parties; but at length, by the mediation of the pope's legate, all differences were adjuſted, and Becket was reinſtated in the ſee of Canterbury.

119 Is reſtored, and behaves with his former inſolence.

On the recovery of his dignity, the primate behaved with all his uſual arrogance. Inſtead of retiring quietly to his dioceſe when he landed in England, he made a progreſs through Kent with all the ſplendor and magnificence of a ſovereign pontiff. As he approached Southwark, the clergy, the laity, and all ranks of people, come forth to meet him, and celebrated his triumphal entry with hymns of joy. Being thus confident of the ſupport of the people, he reſolved to make his enemies feel the ſevereſt effects of his vengeance. He ſuſpended the archbiſhop of York, who had crowned Henry's eldeſt ſon in his abſence. He excommunicated the biſhops of London and Saliſbury, with ſome of the principal nobility and prelates who had aſſiſted at the coronation. One man he excommunicated for having ſpoken againſt him, and another for having cut off the tail of one of his horſes. The excommunicated and degraded prelates immediately made their complaints to the king; and he having dropped ſome paſſionate expreſſions, intimating a deſire to have Becket's life taken away, the ſuppoſed will of the king was inſtantly accompliſhed; nor could the king's expreſs orders to the contrary arrive time enough to hinder the execution of this fatal purpoſe. See BECKET.

120 Grief of the king for his death.

The king was thrown into the utmoſt conſternation on hearing of Becket's murder. He knew that the primate's death would accompliſh what his moſt violent oppoſition during his life could never have done, and therefore he gave himſelf up to ſorrow: for three days he even refuſed all nouriſhment; till at laſt his courtiers were obliged to break in upon his ſolitude, and induce him to acquieſce in an event which could not poſſibly be recalled. The pope was with ſome difficulty made ſenſible of the king's innocence; but refuſed to grant him a pardon, except on condition that he ſhould make every future ſubmiſſion and perform every injunction the holy ſee thought proper to demand. When things were thus adjuſted, the aſſaſſins who had murdered Becket were allowed to retire in ſafety to the enjoyment of their former dignities; and the king, with a view to divert the minds of the people to a different object, undertook an expedition into Ireland, and totally reduced that iſland. See IRELAND.

121 Diſſenſions in Henry's family.

The king was ſcarcely freed from the war with Ireland, and the dangerous controverſy in which he had engaged with the church of Rome, when he found himſelf involved in the moſt unnatural conteſts with his children, to whom he had always behaved in the moſt tender and affectionate manner. He had ordered Henry his eldeſt ſon to be anointed king; and had deſtined him for his ſucceſſor in the kingdom of England, the duchy of Normandy, and the counties of Anjou, Maine, and Touraine; territories which lay contiguous, and which might thus eaſily lend their aſſiſtance to one another. Richard his ſecond ſon was inveſted in the duchy of Guienne and county of Poictou: Geoffrey, his third ſon, inherited, in right of his wife, the duchy of Britanny: and the new conqueſt of Ireland was deſtined for the appendage of John his fourth ſon, for whom he had negociated a marriage with Adelais the only daughter of Humbert count of Savoy and Maurienne; and with whom he was to receive as a dowry very conſiderable demeſnes in Piedmont, Savoy, Breſſe, and Dauphiny. This greatneſs of Henry's family alarmed the king of France; and he therefore excited young Prince Henry to demand of his father, either the immediate reſignation of the crown of England, or the duchy of Normandy. The king refuſed to comply with ſuch an extravagant demand; upon which the prince made his eſcape to Paris, where he was protected by the French king. This happened in 1173; and the ſame year, Queen Eleanor, finding that ſhe was now grown very diſagreeable to the king, communicated her diſcontent to her two younger children Geoffrey and Richard, whom ſhe engaged alſo to demand the territories aſſigned them, and then fly to the court of France. The queen herſelf was meditating an eſcape to the ſame court, and had put on man's apparel for that purpoſe, when ſhe was ſeized and confined by Henry's order. The licentious barons in the mean time wiſhed for a change of government; hoping to have liberty, under young and inexperienced princes, to commit thoſe rapines and violences which they could not do with ſafety when governed by ſuch a prudent and vigilant king as Henry. In the midſt of this univerſal defection, however, the Engliſh monarch ſtill retained his uſual intrepidity, and prepared with as much vigour as poſſible for the conteſt. As he could depend on the fidelity of very few of his nobility, he was obliged to enliſt in his ſervice a number of deſperate ruffians called *Brabençons*, and ſometimes *Routiers* or *Cottereaux*, though for what reaſon is not mentioned in hiſtory. Theſe banditti were very numerous during the times of the feudal government, when many private wars were carried on between the nobles; and 20,000 of theſe, with a few forces furniſhed by his faithful barons, compoſed the whole of Henry's army on this occaſion.

122 Queen Eleanor confined.

With this force the king of England totally overthrew the ſchemes of his enemies on the continent; but being very deſirous of putting an end to the war, he this very year (1173) agreed to a conference with the king of France. At this interview, Henry offered his children the moſt advantageous terms. He inſiſted only on retaining the ſovereign authority in all his dominions. To Henry he offered half the revenues of the crown of England, with ſome places of ſurety in that kingdom; or if he choſe rather to reſide in Normandy, half the revenues of that duchy, with all thoſe of Anjou. He made a like offer to Richard in Guienne; he promiſed to reſign all Britanny to Geoffrey; and if theſe conceſſions were not deemed ſufficient, he agreed to add to them whatever the pope's legates, who were preſent, ſhould require of him. The conference, however, was broken off by the violence of the earl of Leiceſter; who not only reproached Henry in the moſt indecent manner, but even put his hand to his ſword, as if he intended to attempt ſome violence againſt him.

England. In the mean time, the moſt of the Engliſh nobility united in oppoſition againſt their ſovereign; and an irruption at this time by the king of Scotland aſſiſted their rebellious ſchemes. The earl of Leiceſter ſoon after invaded Suffolk at the head of a body of Flemings; but they were repulſed with great ſlaughter and the earl himſelf was taken priſoner. Soon after, William king of Scotland, who had been repulſed, and agreed to a ceſſation of arms, broke the truce, and invaded England with an army of 80,000 men, committing the moſt terrible devaſtations. Henry in the mean time, to reconcile himſelf thoroughly to the church, performed the penances at the tomb of Thomas à Becket which he had formerly promiſed to do. As ſoon as he came within ſight of the church of Canterbury, he alighted from his horſe, walked barefoot towards the town, and proſtrated himſelf before the ſhrine of the ſaint. He remained a whole day in prayer and faſting, watched the holy relics all night, made a grant of 50l. a-year to the convent for a conſtant ſupply of tapers to illuminate the ſhrine; and not ſatisfied with theſe ſubmiſſions, he aſſembled a chapter of monks, diſrobed himſelf before them, put a ſcourge into each of their hands, and preſented his bare ſhoulders to their ſtrokes. Next day he received abſolution; and, departing for London, had the agreeable news of the defeat and captivity of William king of Scotland, which happened on the very day of his abſolution.

123 King of Scotland defeated and taken priſoner.

This victory proved deciſive in Henry's favour. The Engliſh barons who had revolted, or were preparing for a revolt, inſtantly delivered up their caſtles to the victor, and the kingdom was in a few weeks reſtored to perfect tranquillity. Prince Henry, who was ready to embark with a great army to join the Engliſh rebels, abandoned all thoughts of the enterpriſe. Soon after a treaty was concluded with the king of France; in which Henry granted his children much leſs advantageous terms than he had offered them before. The principal were, ſome penſions for their ſupport, caſtles for their reſidence, and an indemnity to all their adherents. The greateſt ſufferer by this war was William king of Scotland. He was compelled to ſign a treaty, by which he obliged himſelf to do homage to Henry for the kingdom of Scotland. It was agreed, that his barons and biſhops ſhould do the ſame; and that the fortreſſes of Edinburgh, Stirling, Berwick, Roxburgh, and Jedburgh, ſhould be delivered into the hands of the conqueror till the articles were performed. This treaty was executed moſt punctually and rigorouſly on the 10th of Auguſt 1175. The king, barons, and prelates of Scotland, did homage to Henry in the cathedral of York; the greateſt humiliation to which the Scottiſh nation had ever been ſubjected.

124 Owns himſelf Henry's vaſſal.

125 New diſſenſions in Henry's family.

Henry was now freed from all troubles, either at home or abroad, for five years; during which time he made ſeveral ſalutary laws for the good of his kingdom. But, in 1180, the ambitious ſpirits of his children involved him in freſh calamities. Richard, who had been inveſted by his father with the ſovereignty of Guienne, refuſed to do homage to his elder brother, as King Henry had required him to do. Young Henry and Geoffrey, uniting their arms, invaded their brother's dominions; and while the king was endeavouring to compoſe their differences, he found himſelf conſpired againſt by them all. The conſpiracy, however, was defeated by the death of Prince Henry in 1183. He had retired to Martel, a caſtle near Turenne, where he was ſeized with a fever; and perceiving the approaches of death, he was at laſt ſtruck with remorſe for his undutiful behaviour towards his father. He ſent a meſſenger to the king, who was not far diſtant; expreſſed his contrition for his faults; and intreated the favour of a viſit, that he might at leaſt die with the ſatisfaction of having received his forgiveneſs. The king, who had ſo often experienced his ſon's ingratitude and violence, apprehended that his ſickneſs was entirely a feint, and dared not truſt himſelf in the prince's hands. But ſoon after, receiving certain intelligence of his death, and proofs of his ſincere repentance, the good old king was affected with the deepeſt ſorrow. He thrice fainted away; he accuſed his own hard-heartedneſs in refuſing the dying requeſt of his ſon; and he lamented that he had deprived the prince of the laſt opportunity of making atonement for his offences. England.

Prince Henry, who died in the 28th year of his age, left no poſterity. His brother Richard ſucceeded to his dominions, and ſoon diſcovered as turbulent a ſpirit as that which had actuated his brother. He refuſed to give up Guienne, which Henry had deſigned for his fourth ſon John; and even made preparations for carrying on war againſt his father, and brother Geoffrey. Henry ſent for Eleanor his queen, the heireſs of Guienne; to whom Richard, either dreading an inſurrection in her favour, or out of a ſenſe of duty, willingly yielded up the territory, and retired peaceably to his father's court. This breach, however, was no ſooner made up, than Geoffrey demanded Anjou to be added to his dominions in Britanny. This the king refuſed; upon which he fled to the court of France, and prepared to levy an army againſt his father. Henry, however, was freed from the danger which threatened him from that quarter, by his ſon's death, who was killed in a tournament at Paris. The loſs of this prince gave few, except the king himſelf, any uneaſineſs; for he was univerſally hated, and went among the people by the name of the *Child of Perdition*. The widow of Geoffrey, ſoon after his deceaſe, was delivered of a ſon, who received the name of *Arthur*, and was inveſted in the duchy of Britanny, under the guardianſhip of his grandfather, who, as duke of Normandy, was alſo ſuperior lord of that territory. Philip, as lord paramount, diſputed for ſome time his title to this wardſhip; but was obliged to yield to the inclinations of the Bretons, who preferred the government of Henry. Some other cauſes inflamed the diſſenſion between theſe two monarchs, and Philip once more ſeduced Richard from his duty. He inſiſted, that his marriage with Adelais, Philip's ſiſter, ſhould be immediately completed, and threatened to enforce his pretenſions with a formidable army. This occaſioned another conference between Giſors and Trie, the uſual place of meeting, under a vaſt elm that is ſaid to have ſhaded more than an acre. In the midſt of this conference the archbiſhop of Tyre appeared before the aſſembly in the moſt miſerable habit, and begged aſſiſtance againſt the infidels, who, under Saladin, had almoſt totally expelled the Chriſtians from Aſia. His intelligence

England. gence appeared so very dismal, that the kings of France and England laid aside their animosity. Both of them immediately took the cross; but Richard, who had long wished to have all the glory of such an expedition to himself, could not bear to have even his father for a partner in his victories. He therefore entered into a confederacy with the king of France; so that Henry found himself at last obliged to give up all thoughts of the crusade, in order to defend himself against this unnatural combination. The event of the war proved very unfortunate for Henry, who lost several towns, and narrowly escaped falling into the hands of the enemy himself. At last a treaty was concluded at the intercession of the duke of Burgundy, the count of Flanders, and the archbishop of Rheims; but upon terms very humiliating to the king of England. It was agreed that Richard should marry the princess Adelais, and be crowned king of England during the lifetime of his father; that Henry, should pay 20,000 marks to the king of France, as a compensation for the charges of the war; that his own barons should engage to make him observe this treaty, and in case of violating it, to join Philip and Richard against him; and that all his vassals who had espoused the cause of Richard should receive an indemnity for their offence. These terms, mortifying as they were, Henry bore with patience; but when, upon receiving a list of the barons that were to be pardoned, he found his own son John, who was his favourite, among them, he could no longer support his grief. He broke out into the most lamentable expressions of despair; cursed the day in which he received his miserable being; and bestowed on his ungrateful children a malediction which he could never afterwards be prevailed upon to retract. Soon after, he fell into a lingering fever occasioned by his grief; and of this he died on the 6th of July 1189, in the 58th year of his age and 35th of his reign. His natural son Geoffrey, who alone had behaved dutifully towards him, attended his corpse to the nunnery of Fontevrault, where it lay in state in the abbey-church. Next day Richard, who came to visit the dead body of his father, was struck with horror at the sight. At his approach, the blood was seen to gush out at the mouth and nostrils of the corpse; and this accident was, by the superstition of the times, interpreted as the most dreadful rebuke. Richard could not endure the sight. He exclaimed that he was his father's murderer; and expressed a strong, though too late, sense of his undutiful conduct.

126 His extreme grief and death.

127 Richard I.

Richard succeeded to the throne without opposition immediately after his father's death; and, on his accession, set his mother Eleanor (who had been again confined) at liberty. A romantic desire for strange adventures, and an immoderate zeal for the external rites of religion, were the ruling passions of the times. By the first of these Richard was inflamed to the highest degree, and therefore behaved as if the whole design of his government had been to attempt the recovery of the Holy Land from the Infidels. The superstition of the people showed itself in a most violent and tragical manner on the very day of the king's coronation. The Jews were the objects of universal hatred, so that Richard had issued out orders forbidding any of them from appearing at his coronation. But some of them bringing him large presents from their nation, presumed, notwithstanding these orders, to approach the hall in which the king dined. Being discovered, they were exposed to the insults and injuries of the bystanders; in consequence of which they fled, and were pursued by the people. A report was spread, that the king had given orders to massacre all the Jews. This supposed command was executed in the most cruel manner. Multitudes were slaughtered in the city of London; and this example was followed in most of the cities in England. Five hundred Jews had retired into York castle for safety: but finding themselves unable to defend the place, they murdered their wives and children; threw the dead bodies over the wall against their enemies who attempted to scale it; and then, setting fire to the houses, perished in the flames. The gentry in the neighbourhood, who were all indebted to the Jews, ran to the cathedral where their bonds were kept, and made a solemn bonfire of them before the altar. England.

128 Massacre of the Jews.

129 Richard's preparations for his journey into Palestine.

Richard immediately began to take measures for his expedition into Palestine. His father had left him 100,000 marks; and this sum he augmented by all expedients he could think of, however pernicious to the public, or dangerous to the royal authority. He set up to sale the revenues and manors of the crown, and several offices of the greatest trust and power. Liberties, charters, castles, were given to the best bidders. His friends warned him of the danger attending this venality; but he told them he would sell the city of London itself, if he could find a purchaser. Numerous exactions were also practised upon all ranks and stations; menaces, promises, and expostulations, were used to fright the timid, and allure the avaricious. A zealous preacher of those times was emboldened to remonstrate against the king's conduct; and advised him to part with his three daughters, which were pride, avarice, and sensuality. To this Richard readily replied, "You counsel right, my friend; and I have already provided husbands for them all. I will dispose of my pride to the templars; my avarice to the monks; and as for my sensuality, the clergy shall share that among them." At length the king having got together a sufficient supply for his undertaking, and even sold his superiority over Scotland for a moderate sum, set out for the Holy Land; whither he was impelled by repeated messages from the king of France, who was ready to embark in the same enterprise.

An account of Richard's exploits in this expedition is given under the articles EGYPT, SICILY, CYPRUS, &c.—Having at last concluded a truce with Saladin, he set out on his return for England. He was, however, at a loss how to proceed. He durst not return by the way he came, as this would put him in the power of the king of France, between whom and the king of England an irreconcilable enmity had taken place. No way therefore was left but by going more to the north; for which reason he took shipping for Italy, but was wrecked near Aquileia. From thence he travelled towards Ragusa, and resolved to make his way through Germany in the habit of a pilgrim. But his expences and liberalities having betrayed him, notwithstanding this disguise, he was arrested by Leopold duke of Austria, who commanded him to be loaded with shackles. This prince had served under Richard

130 Taken prisoner on his return.

England. at the ſiege of Acre (the ancient Ptolemais), where having received ſome diſguſt, he took this baſe method of revenging himſelf. Henry VI. emperor of Germany, was then equally an enemy to Richard on account of his having married Berengaria the daughter of Tancred king of Sicily. He therefore required the royal captive to be delivered up to him, and ſtipulated a large ſum of money to the duke as a reward for his ſervice.

The kingdom of England in the mean time was in great confuſion. Richard had left it under the direction of Hugh biſhop of Durham, and Longchamp biſhop of Ely. The tempers of theſe prelates being very different, an animoſity between them ſoon took place. Longchamp at laſt arreſted his colleague, and obliged him to reſign his power in order to obtain his liberty. The king, by many letters, commanded Longchamp to replace his coadjutor, but to no purpoſe. When the ſituation of the king became uncertain, Longchamp tyrannized to ſuch a degree, that John the king's brother thought proper to oppoſe him. He then left the kingdom; and upon this the archbiſhop of Rouen was made juſticiary in his room. The king of France being informed of theſe diſſenſions, ſtrove to increaſe them as much as poſſible; and had even almoſt prevailed upon John to throw off his allegiance, by promiſing to put him in poſſeſſion of all Richard's continental dominions.

131 Treachery of John the king's brother.

When the Engliſh firſt received the news of Richard's captivity, a general indignation was excited through the whole nation. The greateſt, and almoſt the only traitor in the kingdom, was the king's own brother John. On the very firſt invitation from the court of France, he went abroad, and held a conſultation with Philip, the object of which was the perpetual ruin and captivity of his unhappy brother. He promiſed to deliver into Philip's hands a great part of Normandy; and, in return, he received the inveſtiture of all Richard's tranſmarine dominions: it is even ſaid, that he did homage to the French king for the crown of England.

In conſequence of this treaty, Philip invaded Normandy, and made conſiderable progreſs in the conqueſt of it. He was, however, at laſt repulſed by the earl of Leiceſter, who was now returned from the Holy Land; and a truce was concluded, on condition of paying the French king 20,000 merks, and putting four caſtles into his hands by way of ſecurity for the payment.—John, who had come over to England, met with ſtill leſs ſucceſs in his enterpriſes. He was only able to make himſelf maſter of the caſtles of Windſor and Wallingford; but when he came to London, and demanded the kingdom as heir to this brother, of whoſe death he pretended to have received certain intelligence, he was rejected by all the barons, and meaſures were taken to oppoſe and ſubdue him. The defence of the kingdom was ſo well provided for, that John after ſome fruitleſs efforts, was obliged to conclude a truce with his opponents; and, before the expiration of it, he thought proper to retire to France, where he openly acknowledged his alliance with Philip.

All the efforts of Richard's enemies proved ineffectual to detain him in captivity. He was brought before the diet of the empire at Worms, where the emperor Henry brought againſt him a charge of many crimes and miſdemeanours: but to this the king replied with ſo much ſpirit and eloquence, that the German princes exclaimed loudly againſt the conduct of the emperor; the pope threatened him with excommunication; and Henry, who had hearkened to the propoſals of the king of France and Prince John, found that it would be impoſſible for him to execute his and their baſe purpoſes, and detain the king of England any longer in captivity. He therefore concluded a treaty with him for his ranſom; and agreed to reſtore him to his liberty for 150,000 merks, about 100,000l. of our money, of which 100,000 merks were to be paid immediately, and 67 hoſtages delivered for the remainder. England

132 Richard releaſed from captivity.

The money for the king's ranſom was moſt cheerfully raiſed by the Engliſh. The churches and monaſteries melted down their plate to the amount of 30,000 merks; the biſhops, abbots, and monks, paid a fourth part of their yearly rent; the parochial clergy contributed a tenth part of their tythes; and the requiſite ſum being thus collected, Queen Eleanor and Walter archbiſhop of Rouen ſet out with it for Germany, paid the money to the emperor and duke of Auſtria at Mentz, delivered them hoſtages for the remainder, and freed Richard from his captivity. His eſcape was very critical. Henry had been detected in the aſſaſſination of the biſhop of Liege, and in an attempt of the like nature on the duke of Louvaine; and finding himſelf extremely obnoxious to the German princes on account of theſe odious practices, he had determined to ſeek ſupport from an alliance with the French king, and to detain Richard in perpetual captivity, notwithſtanding the ſum he had already received for his ranſom. He therefore gave orders that Richard ſhould be purſued and arreſted; but the king making all imaginable haſte, had already embarked at the mouth of the Scheldt, and was out of ſight of land when the emperor's meſſengers reached Antwerp. The king of France no ſooner heard of Richard's deliverance, than he wrote to John his confederate in theſe terms: "Take care of yourſelf: the devil is broke looſe."

133 Returns to England

The king of England returned from captivity on the 20th of March 1194, and was received with the utmoſt joy by his ſubjects. He had been but one day landed, when his treacherous brother John came to make his ſubmiſſion. At the interceſſion of Queen Eleanor he was received into favour. "I forgive him (ſaid the king), and hope I ſhall as eaſily forget his offences as he will my pardon." Richard was impatient to revenge himſelf on the king of France, and therefore inſtantly made war upon him. But though both kings were inflamed with the moſt violent reſentment againſt each other, they found it impoſſible to engage their powerful barons heartily in their cauſe. The war, therefore, produced no remarkable event; and, in 1195, was concluded by a truce for five years. On ſome ſlight occaſion it was ready to break out anew, when the pope's legate interpoſed, and a treaty was about to be concluded. King Richard in the mean time was wounded by an arrow at the ſiege of Chalus, a caſtle of Limoges. The wound was not in itſelf dangerous; but being unſkilfully treated, a mortification enſued, and the king expired on the 6th of April 1199, in the 10th year of his reign and 42d of

134 His death

England. his age. By his will he left the kingdom to his brother John, but diſtributed a fourth part of his treaſure among his ſervants.

135 John ſucceeds to the crown.

John ſucceeded to the crown of England without oppoſition, but ſoon found his affairs embarraſſed on the continent. The king of France, who, during the life of King Richard, had always ſupported the pretenſions of John, now gave a like ſupport to the claims of Prince Arthur the ſon of Geoffrey, who, though only 12 years of age, promiſed to be deſerving of the kingdom. But in this matter the king of France ſhowed ſo much regard to his own intereſt, that Conſtantia, the mother of the young prince, thinking that her ally deſigned to keep for himſelf the provinces which he pretended to conquer for Arthur, ſubmitted herſelf and her ſon to John, who detained them in Mans; and thus became undiſputed maſter of the whole empire.

136 His bad qualities.

The new king was weak, tyrannical, cruel, and treacherous. In ſhort, he ſeemed to be endowed with almoſt every bad quality that can fall to the ſhare of man. His conduct, therefore, ſoon rendered him univerſally odious. Imagining himſelf now ſecure on the ſide of France, he indulged his paſſion for Iſabella, the daughter and heireſs of the count of Angouleme, with whom he was much enamoured. His queen, the heireſs of the family of Glouceſter, was ſtill alive; and Iſabella was married to the count de la Marche, though, by reaſon of her youth, the marriage had not been conſummated. John perſuaded the count de Angouleme to carry off his daughter from her huſband; at the ſame time that he procured, under ſome pretence or other, a divorce from the queen. Thus he incurred the diſpleaſure of the pope, and alſo of the count de la Marche, and a powerful confederacy was formed againſt him.

As John had neither courage nor policy ſufficient to keep his barons in awe, he took a method for that purpoſe equally baſe and cruel. This was by hiring a ſet of ruffians, whom he called his *champions*, to fight duels with them, in caſes where they required to clear themſelves from any charge by fighting a duel, according to the cuſtom of thoſe times. Thus he propoſed to get rid of his refractory barons; but they, deſpiſing opponents who were ſo far below their rank, refuſed to fight with them, and a dangerous combination was formed among the barons againſt him.

137 Murders his nephew.

The murder of Prince Arthur rendered John ſtill more generally deteſted. The young prince with his mother had fled to the court of France, where they were received with the greateſt kindneſs, and found their intereſts more vigorouſly ſupported than before. Their enterpriſes were attended with conſiderable ſucceſs, when Arthur himſelf had the misfortune to be taken priſoner. All the other captives were ſent to England; but the prince was ſhut up in the caſtle of Falaiſe, and from that time was never heard of. It was univerſally believed that John had murdered him with his own hand; and this inflamed the general reſentment againſt him to ſuch a degree, that he ſoon after loſt all his French provinces. In 1205, the duchy of Normandy itſelf was alſo conquered by Philip, and John was forced to fly with diſgrace to England.

The king was reſolved to wreak his vengeance upon the barons, who, he pretended, had deſerted his ſtandard in Normandy. For this reaſon, he levied large England. ſums on their eſtates; in order, as he ſaid, to undertake an expedition to the continent. This expedition, however, he ſeveral times capriciouſly deferred; and once having ventured out to ſea, returned again without making the ſmalleſt attempt. At laſt, he landed at Rochelle, and burnt the city of Angiers; but hearing that the enemy were preparing to oppoſe him, he returned without attempting any thing elſe.

This irreſolute and cowardly behaviour of John made him contemptible in the eyes of his ſubjects; but the Norman princes had ſo far extended the prerogatives of the Engliſh crown, that the barons, however diſcontented, durſt not yet attempt to change the form of government. John, by entering into a controverſy with the church, completed his ruin. The clergy, who for ſome time had acted as a community totally indepen- pope. dent of the civil power, had their elections of each other generally confirmed by the pope, to whom alone they owned ſubjection. The election of archbiſhops, however, had been a ſubject of continual diſpute between the ſuffragan biſhops and the Auguſtine monks. In the mean time the archbiſhop of Canterbury died; and the Auguſtine monks, in a very private manner, elected Reginald, their ſuperior, in his place. The biſhops exclaimed againſt this election, as a manifeſt innovation of their privileges; and a furious theological conteſt was likely to enſue. John very imprudently took a ſide in this controverſy, and eſpouſed the cauſe of the ſuffragan biſhops; in conſequence of which, John de Grey biſhop of Norwich was choſen. The cauſe was appealed to Rome; and Pope Innocent III. ſeizing with avidity an opportunity of extending his power, commanded the monks to chooſe Cardinal Stephen Langton, an Engliſhman, then at the court of Rome. The power of nominating an archbiſhop of Canterbury (a perſon of almoſt equal authority with the king), was an acquiſition that would effectually give the court of Rome an unlimited authority over England. John therefore was reſolved not to ſubmit to this impoſition; but he had not judgment ſufficient to conduct him. He violently expelled the monks from their convent, and ſeized upon their revenues. The pope perceiving, from this abſurd conduct, that John was unequal to the taſk he had undertaken, after ſome intreaties, threatened to put the whole kingdom under an interdict. The prelates threw themſelves on their knees before the king, and in the moſt earneſt manner intreated him to avoid the reſentment of the holy tribunal, by receiving the primate, and reſtoring the monks to their convent. John, however, broke out into the moſt violent invectives. He ſwore by *God's teeth* (his uſual oath), that if the kingdom was put under an interdict, he would baniſh the whole body of the clergy, and confiſcate all their poſſeſſions. The pope at laſt, finding he might do it with ſafety, iſſued forth this terrible ſentence, ſo much dreaded by the whole nation. A ſtop was immediately put to divine ſervice, and the adminiſtration of all the ſacraments except baptiſm. The church-doors were ſhut, and the images of the ſaints laid on the ground. The dead were refuſed Chriſtian burial; and were thrown into ditches and on the highways, without any funeral ſolemnity. Marriage was celebrated in the churchyards, and the people prohibited the uſe of meat as in

138 His conteſt with the

139 The kingdom laid under an interdict.

England.

in times of public penance. They were debarred from all pleasure; even from shaving their beards, saluting each other, or paying any regard to their apparel. The clergy deplored the unhappy state of the nation in the most lamentable manner; while John, in revenge, imprisoned all their concubines, and treated the adherents of Langton with the utmost rigour.

140 The king excommunicated, and the kingdom given to Philip of France.

The furious and imprudent efforts of John proved totally ineffectual. He had scarce a friend left in the whole nation; and therefore, in 1209, the pope denounced a sentence of excommunication against him. This was soon followed by another still more terrible; namely, the absolving all the subjects of the king of England from their allegiance, and declaring every one to be excommunicated who had any commerce with him at his table, council, or even in private conversation. The king, rendered quite furious by these repeated indignities, wreaked his vengeance on his unhappy subjects, whose affections he ought rather to have attempted to conciliate. The pope, therefore, proceeded to execute the full measure of his wrath on this devoted prince, by giving away his kingdom to Philip of France. He published a crusade all over Europe against King John; exhorting the nobility, the knights and men of every condition, to take up arms against him, and enlist under the French banner. Philip was not less active on his part. He summoned all the vassals of the crown to attend him at Rouen; and having collected a fleet of 1700 vessels, was ready, in 1213, to invade England.

The pope had now overstretched his power; and had the English nation been governed by a prince of any degree of prudence or resolution, the power of the clergy would in all probability have been totally broken. The people, however superstitious and ready to obey in matters of religion, could not tamely submit to be given away by the pope as slaves from one master to another; and therefore this consideration, added to the natural antipathy subsisting between the French and English, put John, notwithstanding all his offences, at the head of an army of 60,000 men. But the pope was too great a politician to suffer matters to be carried to extremities. He promised himself many more advantages from the submission of John than from an alliance with Philip; and therefore came over in person, or, according to some, sent over his legate, to England, under pretence of conferring with the barons, but in reality to hold a conference with John. He there represented to this forlorn prince, the numbers of the enemy, the hatred of his own subjects, and the secret confederacy there was against him in England. He intimated, that there was but one way to secure him from the impending danger; namely, to put himself under the protection of the pope, who was a merciful father, and still willing to receive a repenting sinner. The abject and irresolute spirit of John submitted to this last piece of arrogance, and he took an oath to obey whatever the pope should command. In consequence of this oath, he took another, the most extraordinary mentioned in the records of history; and

141 John's submission to the pope.

which, as it was taken while he commanded an army of 60,000 men, discovers a meanness of spirit almost incredible. The terms imposed by it were expressed in the following words. "I John, by the grace of God king of England and lord of Ireland, in order to expiate my sins, from my own free will, and the advice of my barons, *give* to the church of Rome, to Pope Innocent and his successors, the kingdom of England, and all other prerogatives of my crown. I will hereafter hold them as the pope's vassal. I will be faithful to God, to the church of Rome, to the pope *my master*, and his successors legitimately elected. I promise to pay him a tribute of 1000 merks; to wit, 700 for the kingdom of England, and 300 for the kingdom of Ireland."

England.

This oath was taken by the king before all the people, kneeling, and with his hands held up between those of the legate. Having then agreed to reinstate Langton in the primacy, he received the crown which he had been supposed to have forfeited; while the legate, to add to his former insolence, trampled under his feet the tribute which John had consented to pay.—The king of France was enraged at this behaviour of the pope; and resolved to execute his project of conquering England, in spite of him and all his censures. His fleet, however, was attacked in their harbours by the English, who took 300 vessels, and destroyed about 100 more; while Philip, finding it impossible to prevent the rest from falling into the hands of the enemy, set fire to them himself, and thus was obliged to give up all hopes of success.

142 The barons attempt to reduce the prerogatives of the crown.

John being thus freed from all danger, continued to follow the same cruel and tyrannical measures which had hitherto rendered him odious to his subjects. His scandalous subjection to the clergy now gave the barons an opportunity of exerting themselves, in order to reduce the enormous prerogatives of the crown. Their designs were greatly facilitated by the concurrence of Langton the primate, who on all occasions showed a sincere regard for the interests of the kingdom. At a synod of his prelates and clergy, convened in St Paul's, on pretence of examining into the losses of some bishops who had been exiled by John, he privately conferred with a number of barons, to whom he expatiated upon the vices and injustice of their sovereign. He showed them a copy of Henry the first's charter; (being the only one in the kingdom, and which had been buried in the rubbish of an obscure mi gallery). Langton exhorted the barons to insist on a renewal of it; and this they solemnly swore to perform. The same agreement was afterwards renewed at a more numerous meeting of barons summoned by Langton at St Edmondsbury. Here it was resolved, that at Christmas they should prefer their common petition in a body, and in the mean time they separated with a design to put themselves in a posture of defence, enlist men, and fortify their castles. In the beginning of January 1215, they repaired to London, accoutred in their military garb and equipage, and presented their petition to the king, alleging that he had promised to grant a confirmation of the laws of Edward the Confessor, at the time he was absolved from his excommunication. John resented their presumption; and required a promise under their hands and seals, that they would never demand, or attempt to extort, such privileges for the future. This they refused with such unanimity and resolution, that the king desired time to consider of their demands. He promised, that, at the festival of Easter, he would give a positive answer to their petition; and offered them the archbishop of Canterbury, the bishop of

England. Ely, and the earl mareſchal, as ſuretics for fulfilling his engagements.

The barons accepted of his ſecurities, and departed peaceably; but John had no deſign of complying with their deſires. He had recourſe to the clergy, whoſe power he had ſeen and felt in ſo many inſtances. He courted their favour, by granting them a charter eſtabliſhing all thoſe rights of which they were already in the poſſeſſion, and which he now pretended to confirm when he had not the liberty to refuſe. To ingratiate himſelf ſtill farther with this body, he took the croſs, and appealed to the pope againſt the uſurpation of the barons. The pope wrote letters to England, reproaching the primate and biſhops with favouring theſe diſſenſions; and commanded them to promote peace between the two parties. He exhorted the barons to conciliate the king, not with menaces, but with humble intreaties; and promiſed, upon their obedience, to interpoſe his own authority in favour of ſuch of their petitions as he ſhould find to be juſt. At the ſame time, he annulled their aſſociation, and forbade them to enter into any confederacy for the future.

The barons paid no regard to the pope's remonſtrances; knowing that the fulminations of the court of Rome would be of little avail, unleſs they were ſeconded by the clergy of England. After waiting till Eaſter, when the king promiſed to return them an anſwer, they met by agreement at Stamford. There they aſſembled a force of above 2000 knights, and a prodigious number of foot. Thence they marched to Brackley, about 15 miles from Oxford, the place where the court then reſided. John, hearing of their approach, ſent the archbiſhop of Canterbury, the earl of Pembroke, and others of his council, to know the particulars of their requeſt, and what thoſe liberties were which they ſo much importuned him to grant. The barons delivered a ſchedule containing the chief articles of their demands, founded on the charters of Henry and Edward; but which were in the higheſt degree diſpleaſing to the king. He burſt into a furious paſſion, aſked the barons why they did not alſo demand his kingdom; and ſwore that he would never comply with ſuch exorbitant demands. The confederates then choſe Robert Fitzwalter for their general; whom they dignified with the title of "Mareſchal of the army of God and of the holy church." They laid ſiege to Northampton, took Bedford, and were joyfully received into London. They wrote letters to all the nobility and gentry who had not yet declared in their favour, threatening their eſtates with devaſtation in caſe of refuſal or delay.

In the mean time the king was left at a place called *Odiham* in Surrey, attended only by ſeven knights. He vainly endeavoured to avert the ſtorm by the mediation of his biſhops and miniſters. He appealed to Langton againſt the barons, not ſuſpecting that he was engaged in the confederacy; and deſired him to fulminate the church cenſures againſt thoſe who had made war upon their lawful prince. Langton declared that he would paſs no cenſure where he found no delinquent; but ſaid, that much might be done if the king would diſmiſs ſome foreign auxiliaries which he had lately brought over. Upon this John diſbanded a great body of Germans and Flemings whom he had hitherto retained in his ſervice, and Langton refuſed to excommunicate a ſingle baron. The king, being now quite defenceleſs, was obliged at laſt to comply with the demands of his ſubjects. A conference was accordingly appointed, and all things were adjuſted for this moſt important treaty. England.

143 They force him to ſign Magna Charta.

The king's commiſſioners met the barons at a place called *Runimede*, between Staines and Windſor; and which is yet held in reverence as the ſpot where the ſtandard of freedom was firſt erected in England. Here the king ſigned the charter called *Magna Charta*: which continues in force to this day, and is ſtill regarded as the great bulwark of Britiſh liberty. See *Magna Charta*.

144 Principal articles of it.

This charter, however, at the time that it was made, ſecured liberty to the clergy, barons, and gentlemen, much more than to the bulk of the people, who did not for a long time obtain any privileges of importance. Freedom of elections was ſecured to the clergy; and it was determined, that fines on them for any offence ſhould be laid on in proportion to their eſtates, and not the value of their benefices. The privileges ſecured to the barons were, either abatements in the rigour of the feudal laws, or relief from arbitrary and ambiguous deciſions before the courts. It was alſo decreed, that barons ſhould recover the lands of their vaſſals, even though forfeited by felony, after having been in the poſſeſſion of the crown for a year and a day; and no tax was to be impoſed without conſent of the great council of the nation, excepting in caſe of the captivity of the king, the knighting of his eldeſt ſon, or marrying his eldeſt daughter. No land belonging to any baron was to be ſeized for a crown debt, unleſs the poſſeſſor had not perſonal property enough to pay it; neither was any vaſſal to be allowed to ſell ſo much of his land as to incapacitate him from performing the neceſſary ſervice to his lord. It was alſo determined, that when the great council of the nation was called, the prelates, earls, and barons, ſhould be ſummoned by a particular writ, and the leſſer barons ſhould receive a ſummons from the ſheriff. In favour of the people it was ſtipulated, that they ſhould have from the barons all the immunities and privileges granted by the king to the former. Merchants were to be allowed to carry on their buſineſs without any arbitrary tolls or impoſitions, and to go out of the kingdom and return at pleaſure. The goods of every freeman were to be diſpoſed of according to his will; or if he died inteſtate, the neareſt heir ſhould ſucceed him. No carts, horſes, or wood, were to be taken by the crown officers without the conſent of the owner. The king's courts were to be ſtationary, and no delay to be made in doing juſtice to every one; no freeman ſhould be taken or impriſoned, diſpoſſeſſed of his free tenement, outlawed or baniſhed, unleſs by the legal judgment of his peers, &c. It was likewiſe ſtipulated, that London ſhould remain in the hands of the barons, and the tower be conſigned to the primate, till the 15th of Auguſt following; or till the articles of the charter ſhould be fulfilled. To give the more ſecurity for this, the king allowed them to chooſe 25 of their own number, to whoſe authority no limits were ſet either in extent or duration. If any complaint were made of a violation of the charter, either by the king or his officers, any four of the barons might admoniſh the king to redreſs the grievance; and if ſatisfaction were not obtained,

England. obtained, they might assemble the whole council of 25; and they, in conjunction with the great council, were empowered to compel him to fulfil the charter. In case of his resistance, they had liberty to levy war against him, attack his castles, and use every kind of violence, except against his person, or those of the queen or children. All men throughout the kingdom were bound, under the penalty of confiscation, to swear obedience to the 25 barons; and the freeholders of each county were to choose 12 knights, whose business it was to report such evil customs as ought to be redressed in terms of Magna Charta.

But although John had thus obliged himself, by writing, to allow liberty to his subjects, he had no mind that they should enjoy it in reality. The sense of his subjection to his own vassals sunk deep in his mind. He became sullen, silent, and reserved. He shunned the society of his former friends; and retired into the isle of Wight, as if to hide his disgrace in solitude; but, in reality, to
145 The king raises an army against his barons. meditate revenge against the barons. He sent to the continent to enlist a large body of mercenary troops, and made complaints to the pope of the insurrections of the barons against him. The pontiff very warmly espoused his cause; a bull was sent over, annulling the whole charter; and at the same time the foreign troops arriving, the king once more found himself in a condition to demand his own terms from his subjects.

The barons had made no preparations for war, not suspecting the introduction of a foreign army. The king, therefore, was for some time undisputed master of the field, and the most horrid cruelties were committed by his army. The nobility who had been most active in procuring the great charter fled with their families to Scotland, where they obtained the protection
146 They offer the kingdom to Louis the French king's son. of King Alexander by doing homage to him. The barons being totally unable to raise an army capable of contending with that of John, applied to their old enemy Philip of France, offering to acknowledge his eldest son Louis for their sovereign, on condition of his protecting them from the fury of John and his mercenaries. The French king accepted their proposal with joy; and twenty-five hostages which he demanded being sent over, began to make the most diligent preparations for this expedition, regardless of the menaces of the pope, who threatened him with excommunication, and actually excommunicated his son Louis some time after.

The first troops who came to the assistance of the barons, were only a body of 7000 men; but, soon after, Louis with a powerful army landed at Sandwich. The first effect of this invasion was, that most of John's foreign troops deserted, refusing to serve against the heir of their monarchy. Many considerable noblemen also deserted his cause, and Louis daily gained ground. This prince advanced to London, where the barons and burghers did him homage, and took the oath of allegiance, after he had sworn to confirm the liberties and privileges of the people. His imprudence, however, in preferring on all occasions his French subjects to the English, soon excited a jealousy against him, which proved very prejudicial to his cause. This jealousy was greatly increased by the death-bed confession of the Count de Melun, one of his courtiers, who declared to those about him, that it was Louis's design to exterminate the English barons as traitors, and to bestow their dignities and estates upon his French subjects, on whose fidelity he could more safely rely. This caused a considerable desertion among Louis's party: so that John once more found himself in a condition to make an effort for his crown. He resolved to penetrate into the heart of the kingdom; and, for this purpose, he departed from Lynn, and took the road towards Lincolnshire at the head of a great body of troops. His road lay along the shore, which was overflowed at high water; but the king, not being apprised of this, or being ignorant of the tides of the place, lost all his carriages, treasure, and baggage by their influx. He himself escaped with the utmost difficulty, and arrived at the abbey of Swinstead; where his grief for the loss he had sustained, and the distracted state of his affairs, threw him into a fever, which soon appeared to be attended with fatal symptoms. He died at Newark in the year 1216, the 51st 147 Death of King John. of his age, and 18th of his reign. He left two legitimate sons: Henry, who succeeded him on the throne, and was about nine years of age; and Richard, who was about seven. He left also three daughters; Jane, married to Alexander king of Scotland; Eleanor, married to the earl of Pembroke; and Isabella, married to the emperor Frederic II.

When John died, the earl of Pembroke was mareschal of England. By this office he was at the head of the army, and of consequence, in times of such turbulence, at the head of the state. He was a nobleman of great honour and fidelity, and had continued faithful to John in his greatest reverses of fortune. He now determined to support the authority of the infant Prince Henry; and therefore carried him immediately to Gloucester, where the ceremony of coronation was performed, in the presence of Gualo the legate and a very few noblemen, by the bishops of Winchester and 148 Henry III. Bath. The young prince was obliged to swear fealty to the pope, and renew the homage which his father had done for the kingdom; after which the earl of Pembroke was chosen protector.

Till the king arrived at the years of maturity, the transactions of his reign can only be considered as the 149 He grants new charters. consequences of the disposition of his tutors. Pembroke caused him grant a new charter of liberties, consisting of the concessions extorted from John, with some alterations; and the next year it was renewed, with the addition of some other articles. Thus these famous charters were brought very nearly to the shape in which they have ever since stood; and they were, during many generations, esteemed the most sacred rampart to national liberty and independence. As they secured the rights of all orders of men, they were anxiously defended by all, and became in a manner the basis of the English monarchy, and a kind of original contract, which both limited the authority of the king, and ensured the conditional allegiance of his subjects. Though often violated, they were still claimed and recalled by the nobility and people; and as no precedents were supposed valid that infringed them, they rather acquired, than lost, authority, from the frequent attempts made against them, in several ages, by regal and arbitrary power.

These charters were made use of by Pembroke as arguments to draw off the malecontent barons from their allegiance to Louis. He represented to them, that, whatever

England. whatever jealouſy they might have entertained againſt the late king, a young prince, the lineal heir of their ancient monarchs, had now ſucceeded to the throne, without ſucceeding either to the reſentments or principles of his predeceſſor: That the deſperate expedient, which they had employed, of calling in a foreign potentate, had, happily for them, as well as for the nation, failed of entire ſucceſs; and it was ſtill in their power, by a quick return to their duty, to reſtore the independence of the kingdom, and to ſecure that liberty for which they ſo zealouſly contended: That, as all paſt offences of the barons were now buried in oblivion, they ought, on their part, to forget their complaints againſt their late ſovereign; who, if he had been anywiſe blameable in his conduct, had left to his ſon the ſalutary warning to avoid his paths, which had led to ſuch fatal extremities: And that, having now obtained a charter for their liberties, it was their intereſt to ſhow, by their conduct, that the acquiſition was not incompatible with their allegiance; and that the rights of the king and people, ſo far from being hoſtile and oppoſite, might mutually ſupport and ſuſtain each other.

150 Decline of Prince Louis's party.

Theſe conſiderations, enforced by Pembroke's known character of conſtancy and fidelity, had a very great influence on the barons. Moſt of them began to negotiate with him, and many actually returned to their duty. At the ſame time Louis continued to diſguſt thoſe of his own party by the preference which he viſibly gave to the French. Though he went over to France, therefore, and brought freſh ſuccours from thence, he found that his party was greatly weaker than before, by the deſertion of his Engliſh confederates; and that the death of King John had, contrary to his expectations, occaſioned the total ruin of his affairs. In a ſhort time Pembroke was ſo much ſtrengthened by deſerters from Louis's party, that he ventured to inveſt Mount Sorel; though upon the approach of the count de Perche with the French army, he deſiſted from that enterpriſe. The French general immediately marched to Lincoln; and, being admitted into the town, laid ſiege to the caſtle, and ſoon reduced it to extremity. Pembroke ſummoned his forces from every quarter, in order to relieve this important place; and he appeared ſo much ſuperior to the French, that they ſhut themſelves up within the city, reſolving to take ſhelter there. But the garriſon of the caſtle, having received a ſtrong reinforcement, made a vigorous ſally upon the beſiegers, while the Engliſh army aſſaulted them from without. The French army was totally routed; the count de Perche with only two perſons more were killed; but many of the chief commanders, and about 400 knights, were made priſoners. On the news of this fatal event, Louis raiſed the ſiege of Dover, and retired to London; where he received intelligence of a new diſaſter, which put an end to all his hopes. A French fleet, which carried a ſtrong reinforcement, had appeared on the coaſt of Kent; where they were attacked and repulſed with conſiderable loſs by Philip d'Albiney. He is ſaid to have gained the victory by the following ſtratagem. Having got the wind of the French, he came down upon them with violence; and throwing on their faces a great quantity of quicklime, which he purpoſely carried on board, they were ſo blinded that they were diſabled from defending themſelves. This misfortune England. ſo diſcouraged the barons who yet adhered to Louis, that they came from every quarter to make their ſubmiſſion to Pembroke: and Louis himſelf, finding his affairs totally deſperate, was glad to make his eſcape from a country where every thing was become hoſtile to him. He therefore concluded a peace with the protector; promiſed to evacuate the kingdom; and only ſtipulated, in return, an indemnity to his adherents, and a reſtitution of their honours and fortunes, together with the free and equal enjoyments of thoſe liberties which had been granted to the reſt of the nation.

151 He leaves the kingdom.

When the king grew up, he was found to be very unfit for the government of ſuch a turbulent people as the Engliſh at that time were. Though his temper was mild and humane, he was alſo very weak, fickle, and irreſolute. He diſguſted the people by the careſſes he beſtowed on foreigners; and this diſguſt roſe once to ſuch a height, that the barons refuſed to aſſemble in the general council of the nation, or parliament, at his deſire. When commanded to do ſo, they ſent a meſſage to Henry, deſiring him to diſmiſs his foreigners; otherwiſe they would drive both him and them out of the kingdom, and put the crown on the head of one who was more worthy to wear it. The facility of Henry's temper alſo induced him to heap riches upon his foreign favourites in a manner which he could by no means afford: this often brought him into very great ſtraits; and to relieve himſelf, he was obliged to have recourſe to many arbitrary meaſures, which he could not otherwiſe have choſen. Nothing, however, of very great moment happened till the year 1255, when the pope found means to embark Henry in a ſcheme for the conqueſt of Naples, or Sicily on this ſide the Fare, as it was called; an enterpriſe which not only brought much diſhonour on the king, but involved him for ſome years in very great expence and trouble. The court of Rome ſome time before had reduced the kingdom of Sicily to the ſame ſtate of feudal vaſſalage which he pretended to exerciſe over England; but Mainfroy, an uſurper, under pretence of governing the kingdom for the lawful heir, had ſeized the crown, and was reſolved to reject the pope's authority. As the pope found that his own force alone was not ſufficient to gain his point, he had recourſe to Richard the king of England's brother, who had been created earl of Cornwall, and had ſuch talents for amaſſing money, that he was reckoned the richeſt prince in Chriſtendom. To him the pope offered the kingdom of Sicily, upon the ſingle condition of his conquering it from the uſurper. Richard was too wiſe to accept this offer; upon which the pope applied to Henry, and offered him the crown of Sicily for his ſecond ſon Edmund. Henry, dazzled by this propoſal, without reflecting on the conſequences, or without conſulting his brother or the parliament, gave the pope unlimited credit to expend whatever ſums he thought neceſſary for completing the conqueſt of Sicily. In conſequence of this unlimited grant, his holineſs determined to exert his apoſtolical authority to the utmoſt, in extorting money from the Engliſh. A cruſade was publiſhed, requiring every one who had taken the croſs againſt the infidels, or even vowed to advance money for that purpoſe, to ſupport the war againſt Mainfroy, whom he accuſed as being a more terrible

152 The pope undertakes the conqueſt of Sicily for Henry's ſon.

153 Intolerable extortions by his holineſs.

English. enemy to the Chriſtian faith than any Saracen. A tenth on all the eccleſiaſtical benefices in England was levied for three years; and orders were given to excommunicate the biſhops who did not make punctual payment. A grant was made to the king of the goods of inteſtate clergymen, as well as of the revenues of vacant benefices and thoſe of non-reſidents. Theſe taxations, however grievous, were ſubmitted to with little murmuring; but another ſuggeſted by the biſhop of Hereford excited the moſt violent clamours. This I relate, who at that time reſided at the court of Rome, drew bills on all the abbots and biſhops of the kingdom, to the amount of no leſs than 150,540 marks, which he granted to Italian merchants in conſideration of the money they had advanced or pretended to advance for the ſupport of the Sicilian war. As it was apprehended that the Engliſh clergy would not eaſily ſubmit to ſuch an extraordinary demand, a commiſſion was given to Ruſtand, the pope's legate, to uſe his authority. An aſſembly of the prelates and abbots was accordingly ſummoned; who, on hearing the propoſal ſanctified with the names both of the pope and king, were ſtruck with the utmoſt ſurpriſe and indignation. A violent altercation took place; during which the legate told them, that all eccleſiaſtical benefices were the property of the pope, and that he might diſpoſe of them as he pleaſed. The affair ended, however, in the ſubmiſſion of the clergy: but the barons ſtill continued refractory, and for ſome time anſwered the king's demands of ſupplies with expoſtulations; urging the king's partiality to foreigners, and the various injuries the nation had ſuſtained from the ſervants of the crown. The great council of the nation, which had lately obtained the name of *parliament*, was therefore diſſolved, and another called, but with as little ſucceſs as before. The king, however, had involved himſelf in ſo much debt, that a large ſupply was become abſolutely neceſſary; and as that could by no means be obtained from parliament, he was now reduced to the humiliating expedient of going about among ſuch of his ſubjects as he thought moſt attached to him, and begging aſſiſtance from them at their own houſes. At length his barons, perceiving the exigences to which he was reduced, ſeemed willing to afford him aid; and, upon his promiſing to grant them a plenary redreſs of grievances, a very liberal ſupply was obtained, for which he renewed their charter with more than uſual ſolemnity. All the prelates and abbots were aſſembled with burning tapers in their hands; the magna charta was read in their preſence; and they denounced ſentence of excommunication upon all who ſhould infringe upon its deciſions. They then put out their tapers on the ground, and exclaimed, "May every ſoul that proves falſe to this agreement ſo ſtink and corrupt in hell." The king ſubjoined, "So help me God, I will inviolably keep all theſe things, as I am a man, as I am a Chriſtian, as I am a knight, and as I am a king crowned and anointed."

[153] Henry ſolemnly renews Magna Charta.

No ſooner had the king received the ſupplies of which he ſtood ſo much in need, than he forgot all his engagements, put his confidence entirely in foreign counſellors, and evaded or broke through in numberleſs inſtances the charters he had given. This conduct rendered him ſo obnoxious to the barons, that Simon Mountfort earl of Leiceſter, a man of a very violent and ambitious temper, determined to attempt a revolution in the government. He formed a powerful confederacy againſt the king, and the deſigns of the conſpirators were effectually put in execution in the year 1258. Henry had ſummoned a parliament in expectation of receiving ſupplies for his Sicilian project; when the barons appeared in the hall, clad in complete armour, with their ſwords by their ſides. The king, ſtruck with this unuſual appearance, aſked them what was their purpoſe, and whether they pretended to make him their priſoner? Roger Bigod, earl mareſchal, anſwered in name of the reſt, that he was not their priſoner; that they even intended to grant him large ſupplies, in order to fix his ſon on the throne of Sicily; that they only expected ſome return for this expence and ſervice; and that as the king had frequently made ſubmiſſions to the parliament, had acknowledged his paſt errors, and had ſtill allowed himſelf to be carried into the ſame path, which gave them ſuch reaſon of complaint, he muſt now yield to more ſtrict regulations, and confer authority on thoſe who were able and willing to redreſs the public grievances. Henry inſtantly aſſured them of his intentions to grant them all poſſible ſatisfaction; and for that purpoſe ſummoned another parliament at Oxford, to digeſt the new plan of government, and to elect proper perſons who were to be entruſted with the chief authority. This aſſembly, afterwards called the *mad parliament*, went very expeditiouſly to work on the buſineſs of reformation. Twenty-four barons were appointed, with ſupreme authority, to reform the abuſes of the ſtate; and Leiceſter was placed at their head. Their firſt ſtep was to order four knights to be choſen out of each county, who ſhould examine into the ſtate of their reſpective conſtituents, and ſhould attend at the enſuing parliament to give information of their complaints. They ordained that three ſeſſions of parliament ſhould be regularly held every year; that a new high ſheriff ſhould be elected annually; that no wards nor caſtles ſhould be entruſted to foreigners, no new foreſts made, nor the revenues of any counties let to farm.

[154] He breaks his engagements, which occaſions a revolution.

[155] Bad conduct of the new rulers.

Theſe conſtitutions were ſo juſt, that ſome of them remain to this day. But the parliament having once obtained the ſovereign power, took care not to part with it again. They not only protracted the time of their ſitting under various pretences; but at laſt had the effrontery to impoſe an oath upon every individual of the nation, declaring an implicit obedience to all the ſtatutes executed or to be yet executed by the barons who were thus appointed as rulers. They not only abridged the authority of the king, but the efficacy of parliament alſo; giving up to 12 perſons the whole parliamentary power between each ſeſſion.—Their uſurpations were firſt oppoſed by the knights of the ſhire, whom they themſelves had appointed. Theſe had for ſome time begun to be regularly aſſembled in a ſeparate houſe, to conſider of the national grievances; the firſt of which was the conduct of the 24 rulers. They repreſented, that though the king had performed all that was required of him, the barons had hitherto done nothing on their part that ſhowed an equal regard for the people; that their own intereſt and power ſeemed the only aim of all their decrees; and they even called upon the king's eldeſt ſon Prince Edward,

England. Edward to interpoſe his authority, and ſave the ſinking nation.

156 Oppreſſed by Prince Edward.

The prince was at this time about 22 years of age, and by his active and reſolute conduct had inſpired the nation with great hopes. He told thoſe who made the application to him, that he had ſworn to the late conſtitutions; and, on that account, though they were contrary to his own private opinions, he was reſolved not to infringe them. At the ſame time, however, he ſent a meſſage to the barons, requiring them to bring their undertaking to an end, or otherwiſe to expect the moſt vigorous reſiſtance to their uſurpations. On this the barons were obliged to publiſh a new code of laws, which, though it contained ſcarce any thing material, yet, it was ſuppoſed, would for a while dazzle the eyes of the people, until they could take meaſures to eſtabliſh their authority upon ſurer foundations. In this manner, under various pretences, they continued their power for three years; while the whole nation loudly condemned their treachery, and the pope himſelf at laſt abſolved the king and his ſubjects from the oath they had taken to obey their injunctions. Soon after this, a parliament was called, and the king reinſtated in his former authority. The barons were obliged to ſubmit for a time; but the earl of Leiceſter having joined the Welſh, who at this time made an irruption into England, the kingdom was reduced to the moſt deplorable ſituation. The puſillanimity of the king prevented any proper or judicious method from being purſued for extricating the people from their diſtreſſes; and at laſt a treaty was concluded with the barons on the moſt diſadvantageous terms that can be imagined. They were reſtored to the ſovereignty of the kingdom, took poſſeſſion of all the royal caſtles and fortreſſes, and even named the officers of the king's houſehold. They ſummoned a parliament to meet at Oxford, in order more fully to ſettle the plan of government; and by this aſſembly it was enacted that the authority of the 24 barons ſhould continue not only during the life of King Henry, but alſo during that of Prince Edward.

157 Who is defeated and taken priſoner, with the king and his brother.

Theſe ſcandalous conditions would have been eaſily complied with by King Henry; but they were utterly rejected by Prince Edward, and a civil war immediately enſued. The prince was at firſt ſucceſsful; but, through his impetuoſity, occaſioned the loſs of a great battle, in which his father and uncle were taken priſoners, and he himſelf was obliged ſoon after to ſurrender to the earl of Leiceſter. The king was now reduced to the moſt deplorable ſituation. His partiſans were totally diſarmed, while thoſe of the earl of Leiceſter ſtill kept themſelves in an offenſive poſture. Leiceſter ſeized the eſtates of no fewer than 18 barons; engroſſed to himſelf the ranſom of all the priſoners; monopolized the ſale of wood to foreign markets; and at laſt ordained that all power ſhould be exerciſed by nine perſons, who were to be choſen by three others, or the majority of them; and theſe three were the earl of Leiceſter himſelf, the earl of Glouceſter, and the biſhop of Chicheſter.

158 Firſt Houſe of Commons.

The miſerable ſituation to which the kingdom was now reduced, proved at laſt the means of ſettling the government on a more proper foundation. Leiceſter, in order to ſecure himſelf, was obliged to have recourſe to an aid, till now entirely unknown in England, namely, that of the body of the people. He called a parliament, where, beſides the barons of his own party, and ſeveral eccleſiaſtics who were not proper tenants of the crown, he ordered returns to be made of two knights from every ſhire; and alſo deputies from the boroughs, which had been hitherto conſidered as too inconſiderable to be allowed any ſhare in the legiſlation. This parliament was called on the 20th of January 1265: and here we find the firſt outline of an Engliſh Houſe of Commons; an inſtitution which has ever ſince been conſidered as the bulwark of Britiſh liberty. England.

The new parliament was far from being ſo compliant to Leiceſter as he had deſired or expected. Many of the barons who had hitherto ſtedfaſtly adhered to his party were diſguſted with his boundleſs ambition; and the people, who found that a change of maſters was not a change from miſery to happineſs, began to wiſh for the re-eſtabliſhment of royal authority. Leiceſter at laſt, to make a merit of what he could not prevent, releaſed Prince Edward from his confinement, and had him introduced at Weſtminſter-hall, where his freedom was confirmed by the unanimous voice of the barons. But though Leiceſter had all the popularity of reſtoring the prince, he was yet politic enough to keep him guarded by his emiſſaries, who watched all his actions. At laſt, however, he found means to make his eſcape in the following manner. The duke of Glouceſter, being diſguſted with Leiceſter, retired from court, and went to his eſtates on the borders of Wales. His antagoniſt purſued him thither: and to give the greater authority to his arms, carried the king and prince of Wales along with him. This furniſhed young Edward with the opportunity he had ſo long deſired. Being furniſhed by the earl of Glouceſter with a horſe of extraordinary ſwiftneſs, he took leave of his attendants, who were in fact his guards, but were not able to come up with him. They purſued him, however, for ſome time; but the appearance of a body of troops belonging to Glouceſter ſoon put an end to their purſuit.

159 Prince Edward recovers his liberty.

The prince no ſooner recovered his liberty, than the royaliſts joined him from all quarters, and an army was ſoon procured which Leiceſter could not withſtand. This nobleman now found himſelf in a remote quarter of the kingdom; ſurrounded by his enemies; and debarred from all communication with his friends by the river Severn, whoſe bridges Edward had broken down. In this extremity, he wrote to his ſon to haſten to his aſſiſtance from London, with a conſiderable body which he had under his command. With this view his ſon advanced to Kenilworth; but here he was ſurpriſed, and his army entirely diſperſed by Prince Edward. The young prince, immediately after this victory, advanced againſt Leiceſter himſelf; who, ignorant of the fate of his ſon's army, had paſſed the Severn in boats. He was by no means able to cope with the royaliſts; his men being inferior both in numbers and reſolution to their antagoniſts. His army was defeated with great ſlaughter. Leiceſter himſelf was ſlain, though he called out for quarter, together with his eldeſt ſon Henry, and about 160 knights and other gentlemen. The old king had been purpoſely placed by the rebels in the front of the battle, where he was wounded, and in great danger of being killed; but, crying out, "I am Henry of Winchеſter your king," he was ſaved and put in a place of ſecurity by his ſon, who

160 Earl of Leiceſter defeated and killed.

England. who had flown to his aſſiſtance. The body of Leiceſter being found among the dead, was barbarouſly mangled by one Roger Mortimer; and then ſent to his widow, as a teſtimony of the royal party's barbarity and ſucceſs.

This victory, gained at Evelham, proved deciſive in favour of the royal party. Almoſt all the caſtles, garriſoned by the barons, haſtened to make their ſubmiſſions, and opened their gates to the king. The Iſle of Axholme alone, and that of Ely, truſting to the ſtrength of their ſituation, ventured to make reſiſtance; but were at laſt reduced, as well as the caſtle of Dover, by the valour and activity of Prince Edward. Adam de Gourdon, a courageous baron, maintained himſelf ſome time in the foreſts of Hampſhire, committing depredations in the neighbourhood; and obliged the prince to lead a body of troops into that country againſt him. Edward attacked the camp of the rebels; and being tranſported by the ardour of action, leaped over the trench with a few followers, and encountered Gourdon himſelf in ſingle combat. The victory was long diſputed between theſe two valiant combatants; but ended at laſt in the prince's favour, who wounded his antagoniſt, threw him from his horſe, and took him priſoner. He not only granted him his life; but introduced him that very night to the queen at Guildford, procured his pardon, and was ever after faithfully ſerved by him.

In 1271, Prince Edward, having ſettled the affairs of the kingdom, undertook an expedition to the Holy Land, where he ſignalized himſelf by many acts of valour. The king's health declined viſibly after the departure of his ſon; and at laſt, worn out with cares and the infirmities of age, he expired at St Edmonſbury on the 16th of November 1272, in the 64th year of his age and the 56th of his reign.

161 Death of Henry III.

Prince Edward had reached Sicily in his return from the Holy Land, when he received an account of his father's death; at which he expreſſed much concern. As he knew that England was at that time in a ſtate of perfect tranquillity, he was in no haſte to return, but ſpent near a year in France before he made his appearance in England. He was received by his ſubjects with the utmoſt joy, and crowned at Weſtminſter by Robert archbiſhop of Canterbury on the 19th of Auguſt 1274. He immediately applied himſelf to the correcting of thoſe diſorders which the civil commotions, and weak adminiſtration of his father, had introduced. A ſyſtem of ſtrict juſtice, bordering on ſeverity, was introduced and kept up through the whole of this reign. The Jews were the only part of his ſubjects whom Edward oppreſſed. Many arbitrary taxes were levied upon them; 280 of them were hanged at once for adulterating the coin; the goods of the reſt were confiſcated, and all of them baniſhed the kingdom.

162 Edward I.

163 Conquers Wales.

In 1276, the king undertook an expedition againſt Lewellyn prince of Wales, who had refuſed to do homage for his crown. The conqueſt of that country was not fully accompliſhed till the year 1283; after which the principality of Wales was annexed to the crown of England, and thenceforth gave a title to the king's eldeſt ſon *.—In 1286, the ſettlement of Wales appeared ſo complete, that the king went abroad in order to make peace between Alfonſo king of Arragon and Philip le Bel king of France, who had a difference about the kingdom of Sicily. He ſucceeded in his negotiations; but, ſtaying abroad three years, he found that many diſorders had been introduced in his abſence. Many inſtances of robbery and violence had broke out in all parts of England; but the corruption of the judges, by which the fountains of juſtice were poiſoned, was of ſtill more dangerous conſequence. Edward, in order to remedy this prevailing abuſe, ſummoned a parliament, and brought the judges to a trial; where all of them except two, who were clergymen, were convicted of this flagrant iniquity, were fined, and depoſed from their office. The amount of the fines levied upon them is of itſelf a ſufficient proof of their guilt, being above 100,000 marks; an immenſe ſum in thoſe days, ſufficient to defray the expences of a war betwixt two great nations. The king afterwards made all the new judges ſwear that they would take no bribes; but the depoſing and fining the old ones was the more effectual remedy. England

* See *Wales*.

In 1291, King Edward began to meditate the conqueſt of Scotland, which employed him during the reſt of his life; but which, though that kingdom was by him reduced to the greateſt diſtreſs, he was never able to accompliſh †. At the ſame time, he was engaged in expenſive conteſts with France; and theſe multiplied wars and preparations for war, by obliging him to have frequent recourſe to parliamentary ſupplies, became the remote cauſes of great and important changes in the government. The parliament was new-modelled into the form which has continued ever ſince. As a great part of the property of the kingdom, by the introduction of commerce and improvements in agriculture, was transferred from the barons to the lower claſs of people, ſo their conſent was thought neceſſary for raiſing the ſupplies. For this reaſon, the king iſſued writs to the ſheriffs, enjoining them to ſend to parliament, along with two knights of the ſhire, two deputies from each borough within their county; and theſe provided with ſufficient powers from their conſtituents to grant ſuch demands as they ſhould think reaſonable for the ſafety of the ſtate. The charges of theſe deputies were to be borne by the boroughs which ſent them; and ſo far were they from conſidering this deputation as an honour, that nothing could be more diſpleaſing to any borough than to be thus obliged to ſend a deputy, or to any individual than to be thus choſen. The authority of theſe commoners, however, increaſed through time. Their union gave them weight; and it became cuſtomary among them, in return for the ſupplies which they granted, to prefer petitions to the crown for the redreſs of thoſe grievances under which the nation was ſuppoſed to labour. The more the king's neceſſities increaſed, the more he found it neceſſary to give them an early redreſs; till, from requeſting, the commons proceeded to requiring; and having all the property of the nation, they by degrees began alſo to be poſſeſſed of the power.

† See *Scotland*.

164 Attempts the conqueſt of Scotland.

165 New-models the parliament.

Edward I. died of a dyſentery at Carliſle on the 7th of July 1307, as he was leading a great army into Scotland, againſt the inhabitants of which he had vowed the moſt dreadful vengeance. He was ſucceeded by his ſon Edward II. whom he had charged with his dying breath to proſecute the war againſt Scotland, and never to deſiſt till he had finally ſubdued the

166 Dies and is ſucceeded by Edw. II.

England. kingdom. But the new king was of a very different diſpoſition from his father. The Scots gradually recovered their power; and in 1314 gave the Engliſh ſuch a terrible defeat at Bannockburn, that for many years no ſuperiority of numbers could encourage them to look the Scots in the face. See SCOTLAND.

167 Diſcontents of his ſubjects. The reign of Edward II. affords no particulars of great moment. Being a prince of a weak underſtanding, though endued with no remarkable bad qualities, his reign was one continued ſeries of quarrels with his turbulent ſubjects. His favourites were the moſt general cauſes of diſcontent. The firſt of theſe was one Piers Gaveſton, the ſon of a Gaſcon knight of ſome diſtinction, who had honourably ſerved the late king, and who, in reward for his ſervices, had obtained an eſtabliſhment for his ſon in the family of the prince of Wales.—To be the favourite of any king whatever, is no doubt in itſelf a ſufficient offence to the reſt of the courtiers. Numberleſs faults were therefore found with Gaveſton by the Engliſh barons. When the king went over to France to eſpouſe the princeſs Iſabella, to whom he had been long contracted, Gaveſton was left guardian of the realm, with more ample powers than had uſually been conferred in ſuch a caſe. But when the queen, who was of an imperious and intriguing ſpirit, arrived, Gaveſton had the misfortune to fall under her diſpleaſure alſo, on account of the aſcendency he had acquired over the king. A conſpiracy was therefore ſoon formed againſt the favourite; at the head of which were the queen, and the earl of Lancaſter, couſin-german to the king, and the moſt opulent and powerful nobleman in England. The king, unable to reſiſt ſuch a combination, was at laſt obliged to baniſh Gaveſton; but recalled him ſome time after. This was ſufficient to ſpread an alarm over the whole kingdom: a civil war enſued; and the nobility having got Gaveſton into their hands, ſoon freed themſelves of any farther apprehenſions from him, by putting him to death.

After the unfortunate defeat at Bannockburn, King Edward choſe a new favourite named *Hugh le Deſpenſer*. He was a young man of a noble Engliſh family, ſome merit, and very engaging accompliſhments. His father was a perſon of a much more reſpectable character than the ſon; but the being admitted to a ſhare of King Edward's favour was a ſufficient crime. The king imprudently diſpoſſeſſed ſome lords of their eſtates, in order to beſtow them upon this favourite; and this was a ſufficient pretence for openly attacking both the father and ſon. The earls of Lancaſter and Hereford flew to arms. Sentence was procured from parliament of perpetual exile againſt the two Spenſers, with a forfeiture of all their eſtates. At laſt the king took the field at the head of 30,000 men, and preſſed the earl of Lancaſter ſo cloſely, that he had not time to collect his forces together; and, flying from one place to another, he was at laſt ſtopped in his way towards Scotland, and made priſoner. He was immediately condemned by a court-martial; and executed on an eminence near Pomfret, with circumſtances of the greateſt indignity.

Spenſer now triumphed for ſome time over his enemies; moſt of the forfeitures were ſeized for his uſe, and he is ſaid to have been guilty of many acts of rapine and injuſtice. But he was ſoon oppoſed by a more formidable enemy. Queen Iſabella fled to France, and refuſed to return to England till Spenſer was removed from the royal preſence, and baniſhed the kingdom. Thus ſhe made herſelf popular in England, where Spenſer was univerſally diſliked; and ſhe had the pleaſure of enjoying the company of a young nobleman named *Mortimer*, upon whom ſhe had lately placed her affections. The queen's court, therefore, became a ſanctuary for all the malecontents who were baniſhed their own country, or who choſe to come over. When ſhe thought matters were ripe for her purpoſe, ſhe ſet ſail from Dort harbour, accompanied by 3000 armed men. She landed without oppoſition on the coaſt of Suffolk, on the 24th of September 1326; and ſhe no ſooner appeared, than there ſeemed to be a general revolt in her favour. The unfortunate king found the ſpirit of diſloyalty ſpread over the whole kingdom. He had placed ſome dependence on the garriſon of Briſtol, which was under the command of the elder Spenſer; but they mutinied againſt their governor; and that unfortunate favourite was delivered up, and condemned by the tumultuous barons to the moſt ignominious death. He was hanged on a gibbet in his armour; his body was cut in pieces and thrown to the dogs; and his head was ſent to Wincheſter, where it was ſet on a pole, and expoſed to the inſults of the populace. Young Spenſer did not long ſurvive his father. He was taken, with ſome others who had followed the fortunes of the wretched king, in an obſcure convent in Wales. The queen had not patience to wait the formality of a trial; but ordered him to be immediately led forth before the inſulting populace, and ſeemed to take a ſavage pleaſure in beholding his diſtreſs. He was executed on a gibbet 50 feet high; his head was ſent to London, where it was received by the citizens with brutal triumph, and fixed on the bridge.

England. 168 Inſurrection againſt him by the Queen.

In the mean time the king, who hoped to find refuge in Wales, was quickly diſcovered, and delivered up to his adverſaries, who inſulted him in the groſſeſt manner. He was conducted to the capital amidſt the inſults and reproaches of the people, and confined in the tower. A charge was ſoon exhibited againſt him; in which no other crimes but his incapacity to govern, his indolence, his love of pleaſure, and his being ſwayed by evil counſellors, were objected againſt him. His depoſition, however, was quickly voted by parliament; he was aſſigned a penſion for his ſupport; his ſon Edward, a youth of 14, was choſen to ſucceed him, and the queen was appointed regent during the minority. The depoſed monarch did not long ſurvive the loſs of his crown. He was at firſt conſigned to the cuſtody of the earl of Lancaſter; but this nobleman ſhowing ſome marks of reſpect and pity, he was taken out of his hands, and delivered over to the lords Berkeley, Mautravers, and Gournay, who were entruſted alternately, each for a month, with the charge of guarding him. While he was in Berkeley's cuſtody, he was ſtill uſed with ſome degree of humanity; but when the turn of Mautravers and Gournay came, every ſpecies of indignity was practiſed upon him, as if they had deſigned to accelerate his death by the bitterneſs of his ſufferings. It is reported, that one day when

169 Edward depoſed;

Edward

England. Edward was to be ſhaved, they ordered cold and dirty water to be brought from a ditch for that purpoſe; and when he deſired it to be changed, and was ſtill denied his requeſt, he burſt into tears and exclaimed, That in ſpite of their inſolence he would be ſhaved with clean and warm water. As his perſecutors, however, ſaw that his death might not arrive, even under every cruelty they could practiſe, and were daily afraid of a revolution in his favour, they determined to rid themſelves of their fears by deſtroying him at once. Mortimer, therefore, ſecretly gave orders to the two keepers, who were at his devotion, inſtantly to diſpatch the king; and theſe ruffians contrived to make the manner of his death as cruel and barbarous as poſſible. Taking advantage of Berkeley's ſickneſs, in whoſe cuſtody he then was, and who was thereby incapacitated from attending his charge, they came to Berkeley-caſtle, and put themſelves in poſſeſſion of the king's perſon. They threw him on a bed, and held him down with a table which they had placed over him. They then ran a horn pipe up his body, through which they conveyed a red-hot iron; and thus burnt his bowels without diſfiguring his body. By this infernal contrivance they expected to have their crime concealed: but the horrid ſhrieks of the king, which were heard at a diſtance from the caſtle, gave a ſuſpicion of the murder; and the whole was ſoon after divulged by the confeſſion of one of the accomplices. Gournay and Mautravers were held in deteſtation by all mankind; and when the enſuing revolution deprived their protectors of power, they found it neceſſary to fly the kingdom. Gournay was afterwards ſeized at Marſeilles, delivered over to the ſeneſchal of Guienne, and put on board a ſhip with a view of carrying him over to England; but he was beheaded at ſea, by ſecret orders, as was ſuppoſed, of ſome nobles and prelates in England, anxious to prevent any diſcovery which he might make of his accomplices. Mautravers concealed himſelf for ſome years in Germany; but having found means of rendering ſome ſervices to Edward III. he ventured to approach his perſon, threw himſelf on his knees before him, and received a pardon.

170 And cruelly murdered.

171 Sovereign power aſſumed by the queen and Mortimer.

By the death of Edward II. the government fell entirely into the hands of the queen and her paramour Mortimer. The parliament, which raiſed young Edward to the throne, had indeed appointed 12 perſons as his privy-council, to direct the operations of government. Mortimer excluded himſelf, under a ſhow of moderation; but at the ſame time ſecretly influenced all the meaſures that came under their deliberation. As this influence began very ſoon to be perceived, and the queen's criminal attachment to Mortimer was univerſally known, theſe governors ſoon became very obnoxious to the people. The firſt ſtroke given to Mortimer's power was during an irruption of the Scots, when the favourite prevented the young king from attacking the enemy. Though it is very probable that the Engliſh army would have been deſtroyed by making an attack on an army ſituated in ſuch an advantageous poſt as the Scots at that time occupied, Mortimer incurred great blame on that account. He was accuſed of having allowed the Scots to make their eſcape; and the general diſguſt on this account was increaſed by his concluding a peace with that kingdom, wherein the Engliſh renounced all title to the ſovereignty of Scotland for the ſum of 30,000 marks. Soon after Mortimer ſeized and executed the earl of Kent, brother to the late king; who, ſuppoſing Edward II. to be ſtill alive, had formed a deſign of reinſtating him in his kingdom. The execution was ſo ſudden, that the young king had not time even to interpoſe in his behalf; and Mortimer ſoon after ſeized this nobleman's eſtate for his own uſe, as he did alſo the immenſe fortunes of the Spenſers. England.

Edward, finding the power of Mortimer a continual reſtraint upon himſelf, reſolved to ſhake off an authority that was likewiſe grown odious to the whole nation. The queen and Mortimer had for ſome time choſen the caſtle of Nottingham for their reſidence. It was ſtrictly guarded, the gates were locked every night, and the keys carried to the queen. It was therefore agreed between the king and ſome of the barons, who ſecretly entered into his deſigns, to ſeize upon them in this fortreſs. Sir William Eland the governor was induced to admit them through a ſubterraneous paſſage, which had been formerly contrived for an outlet, but was now choked up with rubbiſh, and known only to one or two. Through this paſſage the noblemen in the king's intereſt entered the caſtle in the night-time; and Mortimer, without having it in his power to make any reſiſtance, was ſeized in an apartment adjoining to that of the queen. The parliament, which was then ſitting, condemned him, without either permitting him to make his defence, or examining a ſingle witneſs againſt him. He was hanged on a gibbet at a place called *Elmes*, about a mile from London. A ſimilar ſentence was paſſed againſt ſome of his adherents, particularly Gournay and Mautravers, who found an opportunity of eſcaping as above mentioned. The queen, who was perhaps the moſt culpable of the whole, was ſcreened by the dignity of her ſtation. She was, however, depoſed from all ſhare of power; and confined for life to the caſtle of Riſings, with a penſion of 3000 pounds a-year. From this confinement ſhe was never ſet free, though the king paid her an annual viſit of ceremony. She lived 25 years after her depoſition.

172 Mortimer executed.

Edward III. proved the greateſt warrior that ever ſat on the Engliſh throne. He firſt attempted to raiſe Edward Baliol to the ſovereignty of Scotland; but this he found impoſſible fully to accompliſh. Edward next formed a project of invading and conquering France, to the ſovereignty of which he pretended a right. His firſt expectations were attended with ſo little ſucceſs, that on his return to England he found the nation very much diſcontented, and himſelf haraſſed by his numerous creditors, without any ſufficient reſource for paying them. Being determined, however, not to bear any blame himſelf if he could throw it anywhere elſe, he took the firſt opportunity of wreaking his vengeance upon his ſubjects. Finding therefore the tower of London negligently guarded on his arrival, he impriſoned the conſtable and all his inferior officers, treating them with the greateſt ſeverity. He then fell upon the ſheriffs and collectors of the revenue, whom he diſmiſſed from their employments, and appointed an inquiry into their conduct to be made by perſons who, knowing the king's humour, were ſure to find every one guilty who came before them. The keeper of the privy-ſeal, the chief-juſtice, the mayor of London,

173 Edward invades France unſucceſsfully.

174 His ſeverity behaviour on his return.

England. the biſhops of Chicheſter and Litchfield, with the chancellor and treaſurer, were depoſed and impriſoned.

175 Is oppoſed by the archbiſhop of Canterbury; In this career of reſentment and cruelty, however, he found himſelf oppoſed by the archbiſhop of Canterbury, whom he had appointed to collect the taxes laid on for the ſupport of the French war. That prelate happening to be abſent at the time of the king's arrival, did not immediately feel the effects of his reſentment. Being informed, however, of the humour in which his ſovereign was, he iſſued a ſentence of excommunication againſt all who, on any pretence whatever, ſhould exerciſe violence againſt the perſons or eſtates of clergymen, or who infringed thoſe privileges ſecured by the great charter, or who accuſed a prelate of treaſon, or any other crime, in order to bring him under the king's diſpleaſure. A regular combination was formed againſt the king by the clergy, with the primate at their head; who, to excite the indignation of the people as much as poſſible, reported, that the king intended to recal the general pardon and the remiſſion to old debts which had been granted, and to impoſe new and arbitrary taxes without conſent of parliament. The archbiſhop alſo, in a letter to the king, informed him, that there were two powers by which the world was governed, viz. the holy pontifical apoſtolical dignity and the regal authority; of which the clerical power was evidently the ſupreme, as the prieſts were to anſwer even for the conduct of kings at the laſt judgment; and were beſides the ſpiritual fathers of all the faithful, kings and princes not excepted; having, beſides, a heavenly charter, entitling them to direct their wills and actions, and to cenſure their tranſgreſſions. On this the king reſolved to mortify him, by ſending no ſummons to him when the parliament was called: but the prelate, undaunted by this mark of reſentment, appeared before the gates of the parliament-houſe with his croſier in his hand, demanding admittance as the firſt peer of the realm. This application was rejected for two days, but at laſt complied with; and the parliament now ſeemed inclined to abridge the king's authority conſiderably.

176 And obliged at laſt to ſubmit: They began with obſerving, that as the great charter had been violated in many points, particularly by the illegal impriſonment of many freemen and the ſeizure of their goods, it was neceſſary to confirm it anew, and to oblige all the chief officers of the law and others to ſwear to the obſervance of it. It was alſo required, that whenever any of the great offices became vacant, the king ſhould fill them up by the advice of his council and the conſent of ſuch barons as ſhould at the time be found to reſide in the neighbourhood of the court. They enacted alſo, that on the third day of every ſeſſion the king ſhould reſume all ſuch offices into his own hand, excepting thoſe of the juſtices of the two benches and the barons of exchequer; that the miniſters ſhould for the time be reduced to private perſons; that they ſhould in that condition anſwer before parliament to any accuſation preferred againſt them; and that, if they were found in any reſpect guilty, they ſhould be finally deprived of their offices, and others appointed in their ſtead. In return for ſuch ample conceſſions, the king was offered a grant of 20,000 ſacks of wool; and ſuch was his urgent neceſſity, that he was compelled to accept of it even upon theſe terms. Still, however, he determined to adhere to his engagements no longer than till England. this neceſſity was removed. Though the agreement, therefore, was ratified in full parliament, he ſecretly entered a proteſt, that, as ſoon as his convenience permitted, he would from his own authority revoke what had been extorted from him. This proteſt was afterwards confirmed by a public edict; in which he aſſerted, that that ſtatute had been made contrary to law; that it was prejudicial to the prerogatives of the crown, which he had only diſſembled when he ſeemed to ratify it; and that in his own breaſt he had never aſſented to it: and declared, that from thenceforth it had

177 But regains his power. no force or authority. This exertion of arbitrary power, which it might have been imagined would have occaſioned a prodigious clamour, was not taken notice of by any of the ſubſequent parliaments; ſo that in the courſe of two years Edward had entirely regained his authority, and obtained a repeal of the obnoxious

178 Performs great exploits in France. ſtatute juſt mentioned. Having thus ſettled matters to his ſatisfaction, the king reſumed his expedition againſt France, where he gained great advantages. In his abſence the Scots invaded England; but were entirely defeated at Durham, and their king himſelf taken priſoner. The Engliſh king in the mean time continued his victories on the continent; in which he was greatly aſſiſted by Edward ſurnamed the *Black Prince*, the greateſt hero recorded in the Engliſh annals. But for the wars of Edward III. and the exploits of this famous prince, ſee the articles SCOTLAND and FRANCE. The Black Prince died on the 8th of June 1376, and the king ſurvived only about a year. He expired on

179 Richard II the 21ſt of June 1377, and was ſucceeded by his ſecond ſon Richard.

As the new king was only eleven years old when he aſcended the throne, the government was veſted in the hands of his three uncles, the dukes of Lancaſter, York, and Glouceſter. The different diſpoſitions of theſe noblemen, it was thought, would cauſe them check the deſigns of each other. Lancaſter was neither popular nor enterpriſing; York was indolent and weak; and Glouceſter turbulent, popular, and ambitious. Diſcontents firſt aroſe among the common people. They had now acquired a ſhare of liberty ſufficient to inſpire them with a deſire for more, and this deſire was greatly increaſed by the diſcourſes of one John Ball a ſeditious preacher. He went about the country, and inculcated on his audience, that mankind were all derived from one common ſtock; and that all of them had equal right to liberty and the goods of nature, of which they had been deprived by the ambition of a few inſolent rulers.

Theſe doctrines were greedily ſwallowed by the populace, who were farther inflamed by a new impoſition of three groats a-head upon every perſon in the kingdom above 15 years of age. This had been granted as a ſupply by parliament, and was no doubt neceſſary on account of the many expenſive wars in which the kingdom was engaged; but its apparent injuſtice, in laying no more burden upon the rich than the poor, excited the utmoſt reſentment of the people. The manner, too, of collecting this tax, ſoon furniſhed them with an occaſion of revolt. It began in Eſſex, where a report was induſtriouſly ſpread that the peaſants were to be deſtroyed, their houſes burned, and their farms plundered. A blackſmith, well known by the name

of

England.

of *Wat Tyler*, was the firſt that excited them to arms. The tax-gatherers coming to this man's houſe while he was at work, demanded payment for his daughter. This he refuſed, alleging that ſhe was under the age mentioned in the act. One of theſe fellows offered to produce a very indecent proof to the contrary, and at the ſame time laid hold of the maid. This the father reſenting, immediately knocked out the ruffian's brains with his hammer. The byſtanders applauded the action; and exclaimed that it was high time for the people to take vengeance on their tyrants, and to vindicate their native liberty. The whole country immediately took arms, and the inſurgents ſoon amounted to about 100,000 men. They advanced to Blackheath, where they ſent a meſſage to the king, who had taken ſhelter in the tower, deſiring a conference with him. The king was deſirous of complying with their demands, but was intimidated by their fierce behaviour. In the mean time, they entered the city, burning and plundering the houſes of ſuch as were obnoxious for their power or riches. Their animoſity was particularly levelled againſt the lawyers, to whom they ſhowed no mercy. The king at laſt, knowing that the tower was not able to reſiſt their aſſaults, went out among them, and deſired to know their demands. To this they made a very humble remonſtrance; requiring a general pardon, the abolition of ſlavery, freedom of commerce in the market-towns, and a fixed rent inſtead of thoſe ſervices required by the tenure of villenage. The king granted all theſe requeſts; and charters were made out by which the grant was ratified. In the mean time, however, another body of theſe inſurgents had broke into the tower, and murdered the chancellor, the primate, and the treaſurer, with ſome other officers of diſtinction. They then divided themſelves into bodies, and took up their quarters in different parts of the city. At the head of one of theſe was Wat Tyler, who led his men into Smithfield, where he was met by the king, who invited him to a conference under pretence of hearing and redreſſing his grievances. Tyler ordered his companions to retire till he ſhould give them a ſignal, and boldly ventured to begin a conference with the king in the midſt of his retinue. His demands were, That all ſlaves ſhould be ſet free; that all commonages ſhould be open to the poor as well as to the rich; and that a general pardon ſhould be paſſed for the late outrages. Whilſt he made theſe demands, he now and then lifted up his ſword in a menacing manner: which inſolence ſo raiſed the indignation of William Walworth lord mayor of London, that, without conſidering the danger to which he expoſed his majeſty, he ſtunned Tyler with a blow of his mace; while one of the king's knights riding up, diſpatched him with his ſword. The mutineers, ſeeing their leader fall, prepared themſelves to take revenge. Their bows were already bent for execution; when Richard, though not yet 16 years of age, rode up to the rebels, and with admirable preſence of mind cried out: "What, my people, will you kill your king? Be not concerned for the loſs of your leader. I myſelf will now be your general. Follow me into the field, and you ſhall have whatever you deſire." The multitude immediately deſiſted, and followed the king into the fields, where he granted them the ſame charters that he had before granted to their companions. Theſe charters, however, were ſoon after revoked, and the common people reduced to the ſame ſituation in which they had formerly been.

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150 Dangerous inſurrection by Wat Tyler.

151 He is killed.

The courage, addreſs, and preſence of mind, which the king had diſcovered in quelling ſuch a dangerous tumult, gave great hopes to the nation: but, in proportion as Richard advanced in years, theſe hopes were blaſted; and his want of capacity, or at leaſt of ſolid judgment, appeared in every enterpriſe he attempted. The king had unluckily loſt the favour of the common people after the inſurrection juſt mentioned. He allowed the parliament to revoke the charters of enfranchiſement and pardon which had been granted; ſome of the ringleaders in the late diſorders had been ſeverely puniſhed, and ſome even put to death without any form of proceſs or trial. Thus the popular leaders were greatly exaſperated by this cruelty, though probably the king did not follow the dictates of his own mind ſo much in it as the advice of his counſellors. But having thus loſt the favour of one party, he quickly after fell under the diſpleaſure of the other alſo. Suppoſing himſelf to be in too great ſubjection to his uncles, particularly the duke of Glouceſter, he attempted to ſhake off the yoke, by raiſing others to ſuch a degree of power as might enable them to rival them. His firſt favourite was Robert de Vere earl of Oxford, a young man of an agreeable perſon, but diſſolute in his behaviour, who ſoon acquired an abſolute aſcendant over him. So much was he determined to ſhow his attachment to this nobleman, that he firſt created him marquis of Dublin, a title never known in England before; then duke of Ireland; transferring to him the entire ſovereignty of that iſland by patent for life. He gave him in marriage his couſin-german, the daughter of the earl of Bedford; but ſoon after permitted him to divorce her for another lady with whom he had fallen in love. This nobleman ſoon became the diſpenſer of all the king's favours to ſuch a degree, that a conſpiracy was formed againſt him; at the head of which were, Mowbray earl of Nottingham, Fitz Alan earl of Arundel, Piercy earl of Northumberland, Montacute earl of Saliſbury, and Beauchamp earl of Warwick. Vere was impeached in parliament; and though nothing of moment was even alleged againſt him, he was condemned and deprived of his office. They next proceeded to attack the royal authority itſelf. Under pretence that the king was yet unable to govern the kingdom, though at that time 21 years of age, they appointed a commiſſion of 14 perſons to whom the ſovereignty was to be transferred for a year. This meaſure was driven forward by the duke of Glouceſter, and none but his own faction were admitted as members of the committee. The king could not without regret perceive himſelf thus totally deprived of authority. He firſt endeavoured to gain over the parliament to his intereſts, by influencing the ſheriffs of each county, who were then the only returning officers. This meaſure failing, he next applied to the judges. They declared, that the commiſſion which had deprived the king of his authority was unlawful, and that thoſe who procured or adviſed it were puniſhable with death. Their ſentence was quickly oppoſed by declarations from the lords. The duke of Glouceſter armed his partiſans, and appeared at Haringay park near Highgate,

152 The king loſes the favour of the people.

153 His exceſſive favour for the earl of Oxford.

154 A conſpiracy againſt the king.

England. Highgate, at the head of a body of men ſufficient to intimidate the king and all his adherents. Theſe inſurgents, ſenſible of their own power, began by demanding of the king the names of thoſe who had adviſed him to his late raſh meaſures. A few days afterwards they appeared armed in his preſence, and accuſed by name the archbiſhop of York, the duke of Ireland, the earl of Suffolk, and Sir Robert Treſilian, one of the judges who had declared in his favour, together with Sir Nicholas Bember, as public and dangerous enemies to the ſtate. The duke of Ireland fled into Cheſhire, where he attempted to raiſe a body of forces; but was quickly obliged to fly into Flanders, on the arrival of the duke of Glouceſter with a ſuperior army. Soon after, the king was obliged to ſummon a parliament, where an accuſation was drawn up againſt five of his counſellors. Of theſe only Sir Nicholas Bember was preſent; and he was quickly found guilty, condemned, and executed, together with Sir Robert Treſilian, who had been diſcovered and taken during the interval. Lord Beauchamp of Holt was ſoon after condemned and executed; and Sir Simon Burley, who had been appointed the king's governor, ſhared the ſame fate, though the queen continued for three hours on her knees before the duke of Glouceſter, imploring his pardon.

Such unparalleled inſolence and barbarity in a ſubject could not go unpuniſhed. In 1389, the king at an extraordinary council of the nobility aſſembled after Eaſter, to the aſtoniſhment of all preſent, deſired to know his age. Being told that he was turned of two and twenty, he alleged that it was then time for him to govern without help; and that there was no reaſon why he ſhould be deprived of thoſe rights which the meaneſt of his ſubjects enjoyed. The lords anſwered in ſome confuſion, that he had certainly an undiſputed right to take upon himſelf the government of the kingdom. "Yes (replied the king), I have long been under the government of tutors; and I will now firſt ſhow my right to power by their removal." He then ordered Thomas Arundel, whom the commiſſioners had lately appointed chancellor, to give up the ſeals; which he next day delivered to William Wickham biſhop of Wincheſter. He next removed the duke of Glouceſter, the earl of Warwick, and other lords of the oppoſition, from the council; and all the great officers of the houſehold, as well as the judges, were changed.

185 The king takes the power into his own hands.

The king being thus left at liberty to govern as he thought proper, for ſome time behaved in ſuch a manner as to gain the affections of the people. It does not appear indeed that he ever gave much cauſe of complaint; but it was impoſſible for any prince in thoſe days to keep himſelf ſecure on the throne but by a very ſevere and vigorous adminiſtration. The duke of Glouceſter, perceiving that Richard was not of a warlike diſpoſition, frequently ſpoke with contempt of his perſon and government, and deliberated concerning the lawfulneſs of throwing off all allegiance to him. The king being informed of his conduct by ſpies appointed for that purpoſe, at laſt formed a reſolution of ridding himſelf of Glouceſter and his faction at once. He therefore ordered that nobleman to be immediately arreſted and ſent over to Calais, where there was no danger of his being reſcued by his numerous adherents. The earls of Arundel and Warwick were ſeized at the ſame time; and a new parliament, which the king knew would be perfectly obedient to his will, was ſummoned to Weſtminſter. Here the commiſſion of 14, who had uſurped on the royal authority, was annulled for ever; all thoſe acts which had condemned his former miniſters were repealed; and the general pardon which the king had formerly given when he aſſumed the government into his own hands, was revoked. Several of Glouceſter's party were condemned and executed, and at laſt that nobleman himſelf was called for to take his trial as well as the reſt; but he had before been privately diſpatched in priſon. England. 186 Duke of Glouceſter murdered.

After the deſtruction of the duke of Glouceſter and the heads of his party, a miſunderſtanding aroſe among the noblemen who had joined in the proſecution. The duke of Hereford appeared in parliament, and accuſed the duke of Norfolk of having ſpoken ſeditious words againſt his majeſty in a private converſation. Norfolk denied the charge, gave Hereford the lie, and offered to prove his innocence by ſingle combat. The challenge was accepted; but on the day appointed for the duel, the king would not ſuffer the combatants to engage, but commanded both of them to leave the kingdom. The duke of Norfolk he baniſhed for life, but the duke of Hereford only for ten years. The former retired to Venice, where in a ſhort time he died of a broken heart. Hereford behaved in a reſigned and ſubmiſſive manner; which ſo pleaſed the king, that he conſented to ſhorten the time of his baniſhment four years: he alſo granted him letters patent, enſuring him of the enjoyment of any inheritance which ſhould fall to him during his abſence; but upon the death of his father the duke of Lancaſter, which happened ſhortly after, Richard revoked thoſe letters, and kept the eſtate to himſelf. 187 Dukes of Hereford and Norfolk baniſhed.

This laſt injury inflamed the reſentment of Hereford to ſuch a degree, that he formed a deſign of dethroning the king. He was a great favourite both with the army and people; he was immenſely rich, and connected by blood or alliance with all the great families of the nation. The king at the ſame time, it is ſaid, gave himſelf up to an idle, effeminate life; and his miniſters following his example, the national honour was loſt. The number of malecontents daily increaſed, and only waited for the abſence of the king, in order to put their ſchemes in execution; and this opportunity ſoon offered. 188 Hereford forms a ſcheme of dethroning the king.

The earl of March, preſumptive heir to the crown, having been appointed the king's lieutenant in Ireland, was ſlain in a ſkirmiſh with the natives of that country; which ſo incenſed Richard, that, unmindful of his precarious ſituation at home, he went over to Ireland with a conſiderable army, in order to revenge his death in perſon. The duke of Lancaſter (for that was the title which Hereford aſſumed on the death of his father) hearing of the king's abſence, inſtantly embarked at Nantz; and with a retinue only of 60 perſons in three ſmall veſſels, landed at Ravenſpur in Yorkſhire. The earl of Northumberland, who had long been a malecontent, together with Henry Piercy his ſon, who from his ardent valour was ſurnamed *Hotſpur*, immediately joined him with their forces; and the people flocked to him in ſuch numbers, that in a few days his army amounted to 60,000 men.

Richard,

England. Richard, in the mean time, continued in perfect ſecurity in Ireland for ſome time. Contrary winds for three weeks together prevented his receiving any news of the rebellion which was begun in his native dominions. He landed therefore at Milford Haven without ſuſpicion, attended by a body of 20,000 men; but immediately found himſelf oppoſed by a power which he could by no means reſiſt. His army gradually deſerted him, till at laſt he was obliged to acquaint the duke, that he would ſubmit to whatever terms he pleaſed to preſcribe. The duke did not think proper to enter into any treaty with the king; but carried him to London, where he was confined cloſe priſoner in the Tower, formally depoſed by parliament, or rather by the duke of Lancaſter, and at laſt put to death. The manner of his death is variouſly related. According to ſome, eight or nine ruffians were ſent to the caſtle of Pomfret, whither the unhappy prince had been removed, in order to diſpatch him. They ruſhed unexpectedly into his apartment; but Richard, knowing their deſign, reſolved to ſell his life as dear as poſſible. He wreſted a pole-axe from one of the murderers, with which he killed four of them; but was at length overpowered and killed. Others relate that he was ſtarved in priſon; and that, after he was denied all nouriſhment, he prolonged his life 14 days, by feeding on the ſtocks of his bed. He died in the year 1399, in the 34th year of his age, and 23d of his reign.—It was during the reign of Richard II. that Wickliff, the noted reformer, publiſhed his doctrines in England. See WICKLIFF.

189 Richard depoſed and murdered.

190 Duke of Lancaſter's claim to the crown.

After ſentence of depoſition had been pronounced on Richard by both houſes of parliament, the throne being then vacant, the duke of Lancaſter ſtepped forth; and having croſſed himſelf on the forehead and on the breaſt, and called on the name of Chriſt, gave in his claim to the throne in the following words, which we ſhall give in the original language. "In the name of Fadher, Son, and Holy Ghoſt, I Henry of Lancaſter, challenge this rewme of Ynglonde, and the croun, with all the membres and the appurtenances; als I that am deſcendit by right line of the blode, coming fro the gude King Henry therde, and throge that right that God of his grace hath ſent me, with help of kyn, and of my frendes to recover it; the which rewme was in poynt to be ondone by defaut of governance, and ondoying of the gude laws."

The right which the duke here claimed by deſcent from Henry III. proceeded on a falſe ſtory, that Edmund earl of Lancaſter, ſon of Henry III was really the elder brother of Edward I.; but that, by reaſon of ſome deformity in his perſon, he had been poſtponed in the ſucceſſion, and Edward the younger brother impoſed on the nation in his ſtead. The preſent duke of Lancaſter inherited from Edmund, by his mother, the right which he now pretended to the crown; though the falſehood of the ſtory was ſo generally known, that he thought proper to mention it only in general terms.—No oppoſition, however, was made to the validity of this title in parliament; and thus commenced the differences between the houſes of York and Lancaſter, which were not terminated but by many bloody and ruinous wars.

191 Henry IV.

The reign of Henry IV. was little elſe than a continued ſeries of inſurrections. In the very firſt parliament he called, no fewer than 40 challenges were given and accepted by different barons; and though Henry had ability and addreſs enough to prevent theſe duels from being fought, it was not in his power to prevent continual inſurrections and combinations againſt himſelf. The moſt formidable one was conducted by the earl of Northumberland, and commenced A. D. 1402. The occaſion of it was, that Henry denied the earl liberty to ranſom ſome Scots priſoners which had been taken in a ſkirmiſh with that nation. The king was deſirous of detaining them in order to increaſe his demands upon Scotland in making peace; but as the ranſom of priſoners was in that age looked upon as a right belonging to thoſe who had taken them, the earl thought himſelf grievouſly injured. The injury appeared ſtill the greater, becauſe Northumberland conſidered the king as indebted to him both for his life and crown. He reſolved therefore to dethrone Henry; and to raiſe to the throne young Mortimer, who was the true heir to the crown, as being the ſon of Roger Mortimer earl of March, whom Richard II. had declared his ſucceſſor. For this purpoſe, he entered into an alliance with the Scots and Welſh, who were to make an irruption into England at the ſame time that he himſelf was to raiſe what forces he could in order to join them. But when all things were prepared for this inſurrection, the earl found himſelf unable to lead on the troops, by a ſudden fit of illneſs with which he was ſeized at Berwick. On this, young Piercy (ſurnamed *Hotſpur*) took the command; and marched towards Shrewſbury, in order to join the Welſh. But the king had happily a ſmall army with which he intended to have acted againſt the Scots; and knowing the importance of celerity in civil wars, inſtantly hurried down, that he might give battle to the rebels. He approached Shrewſbury before a junction with the Welſh could be effected; and the impatience of Piercy urged him to an engagement, which at that time he ought to have declined. The evening before the battle, he ſent a manifeſto to Henry; in which he renounced his allegiance, ſet the king at defiance, and enumerated all the grievances of which he imagined the nation might juſtly complain. He reproached him (and very juſtly) with his perjury; for Henry, on his firſt landing in England, had ſworn upon the goſpels, before the earl of Northumberland, that he had no other intention but to recover poſſeſſion of the duchy of Lancaſter, and that he would ever remain a faithful ſubject to King Richard. He aggravated his guilt, in firſt dethroning and then murdering that prince; and in uſurping on the title of the houſe of Mortimer; to whom, both by lineal ſucceſſion and by declarations of parliament, the throne, then vacant by Richard's death, did of right belong. Several other heavy charges were brought againſt him; which, at that time, could be productive of no other effect than to irritate the king and his adherents to the utmoſt.

England.

192 Inſurrection of the earl of Northumberland.

The armies on each ſide were in number about 12,000; ſo that they were not unmanageable by their commanders; and as both leaders were men of known bravery, an obſtinate engagement was expected. The battle was fought on the 20th of July 1403; and we can ſcarce find in thoſe ages any other in which the ſhock was ſo terrible and conſtant. At laſt Piercy being killed by an unknown hand, the victory was decided in

193 His ſon defeated and killed at Shrewſbury.

England. in favour of the royaliſts. There are ſaid to have fallen on that day near 2300 gentlemen, and 6000 private men, of whom near two thirds were of Piercy's army.

The earl of Northumberland having recovered from his ſickneſs, and levied an army, was on his march to join his ſon; but being oppoſed by the earl of Weſtmorland, and hearing of the defeat at Shrewſbury, he diſmiſſed his forces, and came with a ſmall retinue to the king at York. He pretended that his ſole intention was to mediate between the contending parties; and the king thought proper to accept of his apology, and grant him a pardon for his offence. The other rebels were treated with equal lenity; and none of them, except the earl of Worceſter and Sir Richard Vernon, who were regarded as the chief authors of the inſurrection, periſhed by the hands of the executioner. This lenity, however, was not ſufficient to keep the kingdom quiet; one inſurrection followed another almoſt during the whole of this reign; but either through Henry's vigilance, or the bad management of the conſpirators, they never could unite their forces in ſuch a manner as was neceſſary for bringing their projects to bear.

194 Archbiſhop of York executed.

This reign is remarkable for the firſt capital puniſhment inflicted on a clergyman of high rank. The archbiſhop of York having been concerned in an inſurrection againſt the king, and happening to be taken priſoner, was beheaded without either indictment, trial, or defence; nor was any diſturbance occaſioned by this ſummary execution. But the moſt remarkable tranſaction of this reign was, the introduction of that abſurd and cruel practice of burning people on account of their religion. Henry, while a ſubject, was thought to have been very favourable to the doctrines of Wickliff; but when he came to the throne, finding his poſſeſſion of it very inſecure, he thought ſuperſtition a neceſſary implement of his authority, and therefore determined by all means to pay court to the clergy. There were hitherto no penal laws againſt hereſy; not indeed through the toleration of the court of Rome, but through the ſtupidity of the people, who could not perceive the abſurdities of the eſtabliſhed religion. But when the learning and genius of Wickliff had once broken the fetters of prejudice, the eccleſiaſtics called aloud for the puniſhment of his diſciples; and Henry, who was very little ſcrupulous in his conduct, reſolved to gratify them. He engaged parliament to paſs a law for this purpoſe: it was enacted, that when any heretic, who relapſed, or refuſed to abjure his opinions, was delivered over to the ſecular arm by the biſhop or his commiſſaries, he ſhould be committed to the flames before the whole people. This weapon did not remain long unemployed in the hands of the clergy. William Sautré, rector of St Oſithes in London, had been condemned by the convocation of Canterbury; his ſentence was ratified by the houſe of peers; the king iſſued his writ for the execution; and the unhappy man was burnt alive in the year 1401. The doctrines of Wickliff, however, ſeem to have already gained ground very conſiderably in England. In 1405, the commons, who had been required to grant ſupplies, propoſed in plain terms to the king to ſeize all the temporalities of the church, and employ them as a perpetual fund to ſerve the exigencies of the ſtate. They inſiſted that the clergy poſſeſſed a third of the lands of the kingdom; and they contributed nothing to the public burdens; and that their exorbitant riches tended only to diſqualify them from performing their miniſterial functions with proper zeal and attention. When this addreſs was preſented, the archbiſhop of Canterbury, who then attended the king, objected that the clergy, though they went not in perſon to the wars, ſent their vaſſals and tenants in all caſes of neceſſity; while at the ſame time, they themſelves who ſtaid at home were employed night and day in offering up their prayers for the happineſs and proſperity of the ſtate. The ſpeaker anſwered with a ſmile, that he thought the prayers of the church but a very ſlender ſupply. The archbiſhop, however, prevailed in the diſpute; the king diſcouraged the application of the commons; and the lords rejected the bill which the lower houſe had framed for deſpoiling the church of her revenues. The commons were not diſcouraged by this repulſe. In 1410, they returned to the charge with more zeal than before. They made a calculation of all the eccleſiaſtical revenues, which, by their account, amounted to 485,000 marks a-year, and included 18,400 ploughs of land. They propoſed to divide this property among 15 new earls, 1500 knights, 6000 eſquires, and 100 hoſpitals; beſides 20,000l. a-year, which the king might keep for his own uſe: and they inſiſted that the clerical functions would be better performed than at preſent, by 15,000 pariſh prieſts, at the rate of 7 marks a-piece of yearly ſtipend. This application was accompanied with an addreſs for mitigating the ſtatutes enacted againſt the Wickliffites or Lollards, ſo that the king knew very well from what ſource it came. He gave the commons, however, a ſevere reply; and further to ſatisfy the church that he was in earneſt, ordered a Lollard to be burnt before the diſſolution of parliament.

195 Burning of heretics introduced.

The king had been for ſome time ſubject to fits, which continued to increaſe, and gradually brought him to his end. He expired at Weſtminſter in 1413, in the 46th year of his age, and the 13th of his reign. 196 Henry V.
He was ſucceeded by his ſon Henry V. whoſe martial talents and character had at firſt occaſioned unreaſonable jealouſies in the mind of his father, ſo that he thought proper to exclude him from all ſhare of public buſineſs. The active ſpirit of Henry being thus reſtrained from its proper exerciſe, broke out in every kind of extravagance and diſſipation. It is even reported, that, when heated with liquor, he ſcrupled not to accompany his riotous aſſociates in attacking the paſſengers on the ſtreets and highways, and robbing them of their goods. No ſooner, however, did he aſcend the throne, than he called together his former companions, acquainted them with his intended reformation, exhorted them to imitate his example; but ſtrictly prohibited them, till they had given proofs of their ſincerity in this particular, to appear any more in his preſence: after which, he diſmiſſed them with liberal preſents. His father's wiſe miniſters, who had checked his riots, found that they had, unknown to themſelves, been paying the higheſt court to their ſovereign; and were received with all the marks of favour and confidence. The chief juſtice, who had formerly impriſoned the prince himſelf, and therefore trembled to approach the royal preſence, met with

praiſes

England. praiſes inſtead of reproaches for his paſt conduct, and was exhorted to perſevere in the ſame rigorous and impartial execution of the laws. The king was not only anxious to repair his own miſconduct, but alſo to make amends for thoſe iniquities into which policy or neceſſity of affairs had betrayed his father. He expreſſed the deepeſt ſorrow for the fate of the unhappy King Richard, and even performed his funeral obſequies with pomp and ſolemnity, and heaped favours upon all thoſe who had ſhown themſelves attached to him. He took into favour the young earl of March, though his competitor for the throne; and gained ſo far on his gentle and unambitious nature, that he remained ever after ſincerely attached to him. The family of Piercy was reſtored to its fortune and honours; and the king ſeemed deſirous to bury all diſtinctions in oblivion. Men of merit were preferred, whatever party they had been of; all men were unanimous in their attachment to Henry; and the defects of his title were forgotten amidſt the perſonal regard which was univerſally paid him.

197 Enforces the laws againſt heretics.

The only party which Henry was not able to overcome was the new ſect of Lollards, or reformers of religion. Theſe were now gaining ſuch ground in England, that the Romiſh clergy were greatly alarmed, and Henry was determined to execute the laws upon them. The head of that party at preſent was Sir John Oldcaſtle, Lord Cobham; a nobleman who had diſtinguiſhed himſelf by his valour and military talents on many occaſions, and acquired the eſteem both of the late and preſent king. His high character and zeal for the new ſect pointed him out to Arundel archbiſhop of Canterbury as a proper object of eccleſiaſtical fury, and therefore he applied to Henry for permiſſion to indict him. The king deſired him firſt to try gentle methods, and undertook to converſe with Lord Cobham himſelf upon religious ſubjects. He did ſo, but could not prevail, and therefore abandoned Cobham to his enemies. He was immediately condemned to the flames: but having found means to make his eſcape, he raiſed an inſurrection; which was ſoon ſuppreſſed, without any other conſequence than that of bringing a ſtain on the ſect to which he belonged. Cobham himſelf made his eſcape, but four years afterwards was taken and executed as a traitor. Immediately after, the moſt ſevere laws were paſſed againſt the Lollards. It was enacted, that whoever was convicted of Lollardy, beſides ſuffering capital puniſhment according to the laws formerly eſtabliſhed, ſhould alſo forfeit his lands and goods to the king; and that the chancellor, treaſurer, juſtices of the two benches, ſheriffs, juſtices of the peace, and all the chief magiſtrates in every city and borough, ſhould take an oath to uſe their utmoſt endeavours for the extirpation of hereſy.

Notwithſtanding theſe terrible laws, the very parliament which enacted them, namely that of 1414, when the king demanded a ſupply, renewed the offer formerly preſſed upon Henry IV. and intreated the king to ſeize all the eccleſiaſtical revenues, and convert them to the uſe of the crown. The clergy were greatly alarmed. They could offer the king nothing of equal value. They agreed, however, to confer on him all the priories alien, which depended on capital abbeys in Normandy, and which had been bequeathed to them when that province was united to England. The moſt effectual method, however, of warding off the blow at preſent was by perſuading the king to undertake a war with France, in order to recover the provinces in that kingdom which had formerly belonged to England. This was agreeable to the dying injunction of Henry IV. He adviſed his ſon never to let the Engliſh remain long in peace, which was apt to breed inteſtine commotions; but to employ them in foreign expeditions, by which the prince might acquire honour, the nobility in ſharing his dangers might attach themſelves to his perſon, and all the reſtleſs ſpirits find occupation for their inquietude. The natural diſpoſition of Henry ſufficiently inclined him to follow this advice, and the civil diſorders of France gave him the faireſt proſpect of ſucceſs. Accordingly, in 1415, 198 France invaded. the king invaded France at the head of 30,000 men. The great progreſs he made there is related at length under the article FRANCE. He had eſpouſed the king's daughter, and conquered the greateſt part of the kingdom. His queen was delivered of a ſon named *Henry*, whoſe birth was celebrated by the greateſt rejoicings both at London and Paris; and the infant prince ſeemed to be univerſally regarded as heir to both monarchies. But Henry's glory, when it ſeemed to be approaching the ſummit, was blaſted at once by death, and all his mighty projects vaniſhed. He was ſeized with a fiſtula, a diſtemper which at that time the phyſicians had not ſkill enough to cure; and he expired on the 31ſt 199 Death of Henry V. of Auguſt 1422, in the 34th year of his age, and the 10th of his reign.

200 Henry VI.

Henry VI. ſucceeded to the throne before he was quite a year old, and his reign affords only the moſt diſmal accounts of misfortunes and civil wars. His relations very ſoon began to diſpute about the adminiſtration during the minority. The duke of Bedford, one of the moſt accompliſhed princes of the age, was appointed by parliament protector of England, defender of the church, and firſt counſellor to the king. His brother, the duke of Glouceſter, was fixed upon to govern in his abſence, while he conducted the war in France; and in order to limit the power of both brothers, a council was named, without whoſe advice and approbation no meaſure could be carried into execution.

The kingdom of France was now in the moſt deſperate ſituation. The Engliſh were maſters of almoſt the whole of it. Henry VI. though but an infant, was ſolemnly inveſted with regal power by legates from Paris; ſo that Charles VII. of France ſucceeded only to a nominal kingdom. With all theſe great advantages, however, the Engliſh daily loſt ground; and in the year 1450 were totally expelled from France *. It * See *France*. may eaſily be imagined, that ſuch a train of bad ſucceſs would produce diſcontents among the rulers at home. The duke of Glouceſter was envied by many on account of his high ſtation. Among theſe was Henry Beaufort, biſhop of Wincheſter, great uncle to the king, and the legitimate ſon of John of Gaunt brother to Richard II. The prelate, to whom the care of the king's education had been committed, was a man of great capacity and experience, but of an intriguing and dangerous diſpoſition. He had frequent diſputes with the duke of Glouceſter, over whom he gained ſeveral advantages on account of his open temper. The duke of Bed-

England. ford employed both his own authority and that of parliament to reconcile them, but in vain; their mutual animoſities ſerved for ſeveral years to embarraſs government, and to give its enemies every advantage. The ſentiments of the two leaders were particularly divided with regard to France. The biſhop laid hold of every proſpect of accommodation with that country; and the duke of Glouceſter was for maintaining the honour of the Engliſh arms, and regaining whatever had been loſt by defeats or delay. Both parties called in all the auxiliaries they could. The biſhop reſolved to ſtrengthen himſelf by procuring a proper match for Henry, at that time 23 years old; and then bringing over the queen to his intereſts. Accordingly, the earl of Suffolk, a nobleman whom he knew to be ſtedfaſt in his attachments, was ſent over to France, apparently to ſettle the terms of a truce which had then been begun, but in reality to procure a ſuitable match for the king.

201 Married to Margaret of Anjou.

The biſhop and his friends had caſt their eyes on Margaret of Anjou, daughter of Regnier, titular king of Sicily, Naples, and Jeruſalem; but without either real power or poſſeſſions. She was conſidered as the moſt accompliſhed princeſs of the age, both in mind and perſon; and it was thought would, by her own abilities, be able to ſupply the defects of her huſband, who appeared weak, timid, and ſuperſtitious. The treaty was therefore haſtened on by Suffolk, and ſoon after ratified in England. The queen came immediately into the biſhop's meaſures: Glouceſter was deprived of all real power, and every method taken to render him odious to the public. One ſtep taken for this purpoſe was to accuſe his ducheſs of witchcraft. She was charged with converſing with one Roger Bolingbroke, a prieſt and reputed necromancer; and alſo with one Mary Gourdemain, who was ſaid to be a witch. It was aſſerted that theſe three in conjunction had made an image of the king in wax, which was placed before a gentle fire: and as the wax diſſolved, the king's ſtrength was expected to waſte; and upon its total diſſolution, his life was to be at an end. This accuſation was readily believed in that ſuperſtitious age. The priſoners were pronounced guilty; the ducheſs was condemned to do penance and ſuffer perpetual impriſonment; Bolingbroke the prieſt was hanged, and the woman burnt in Smithfield.

The biſhop, called alſo the *Cardinal*, of Winchеſter, was reſolved to carry his reſentment againſt Glouceſter to the utmoſt. He procured a parliament to be ſummoned, not at London, which was too well affected to the duke, but at St Edmundſbury, where his adherents were ſufficiently numerous to overawe every opponent. As ſoon as Glouceſter appeared, he was accuſed of treaſon and thrown into priſon; and on the day on which he was to make his defence, he was found dead in his bed, though without any ſigns of violence upon his body.

202 Duke of Glouceſter murdered.

The death of the duke of Glouceſter was univerſally aſcribed to the cardinal of Winchеſter, who himſelf died ſix weeks after, teſtifying the utmoſt remorſe for the bloody ſcene he had acted. What ſhare the queen had in this tranſaction, is uncertain: but moſt people believed that without her knowledge the duke's enemies durſt not have ventured to take away his life. The king himſelf ſhared in the general ill-will, and he never had the art to remove the ſuſpicion. His incapacity alſo began every day to appear more clearly, and a pretender to the throne ſoon made his appearance. England.

203 Duke of York's title to the crown.

In the year 1450, Richard duke of York began to think of preferring his claims to the crown. All the males of the houſe of Mortimer were extinct; but Anne, the ſiſter of the laſt earl of March, having eſpouſed the earl of Cambridge, who had been beheaded for treaſon in the reign of Henry V. had tranſmitted her latent, but not yet forgotten claim, to her ſon Richard. This prince, deſcended by his mother from Philippa, only daughter of the duke of Clarence, ſecond ſon of Edward III. ſtood plainly in order of ſucceſſion before the king; who derived his deſcent from the duke of Lancaſter, third ſon of that monarch. The duke was a man of valour and abilities, as well as of ſome ambition; and he thought the weakneſs and unpopularity of the preſent reign afforded a favourable opportunity to aſſert his title. The enſign of Richard was a white roſe, that of Henry a red one; and this gave names to the two factions, who were now about to drench the kingdom in blood.

204 Duke of Suffolk baniſhed,

After the cardinal of Winchеſter's death, the duke of Suffolk, who alſo had been concerned in the aſſaſſination of Glouceſter, governed every thing with uncontrollable ſway. His conduct ſoon excited the jealouſy of the other nobility, and every odious or unſucceſsful meaſure was attributed to him. The duke, however, imagining that his crimes were of ſuch a nature as could not be proved, boldly called upon his enemies to ſhow an inſtance of his guilt. The houſe of commons immediately opened againſt him a charge of corruption, tyranny, and treaſon. He was accuſed of being the cauſe of the loſs of France; of perſuading the French king, with an armed force, to invade England; and of betraying the ſecrets of ſtate. The popular reſentment againſt him was ſo ſtrong, that Henry, in order to ſecure him as much as poſſible, ſentenced him to five years baniſhment. This was conſidered by his enemies as an eſcape from juſtice. The captain of a ſhip was therefore employed to intercept him in his paſſage to France. He was ſeized near Dover, his head ſtruck off on the ſide of a long-boat, and his body thrown into the ſea.

205 And murdered.

206 Inſurrection of Jack Cade.

The complaints againſt Henry's government were heightened by an inſurrection headed by one John Cade, a native of Ireland. He had been obliged to fly over into France for his crimes: but, on his return, ſeeing the people prepared for violent meaſures, he aſſumed the name of *Mortimer;* and, at the head of 20,000 Kentiſh men, advanced towards Blackheath. The king ſent a meſſage to demand the cauſe of their riſing in arms. Cade in the name of the community anſwered, That their only aim was to puniſh evil miniſters, and procure a redreſs of grievances for the people. On this a body of 15,000 troops was levied; and Henry marched with them in perſon againſt Cade, who retired on his approach, as if he had been afraid of coming to an engagement. He lay in ambuſh, however, in a wood; not doubting but he ſhould be purſued by the king's whole army: but Henry was content with ſending a detachment after the fugitives, and returned to London himſelf; upon which Cade iſſued from his ambuſcade, and cut the detachment in pieces.

Soon

England. Soon after, the citizens of London opened their gates to the victor; and Cade, for ſome time, maintained great order and regularity among his followers. He always led them out into the fields in the night-time, and publiſhed ſeveral edicts againſt plunder and violence of any kind. He was not, however, long able to keep his people in ſubjection. He beheaded the treaſurer Lord Say, without any trial; and ſoon after, his troops committing ſome irregularities, the citizens reſolved to ſhut their gates againſt him. Cade endeavouring to force his way, a battle enſued, which laſted all day, and was ended only by the approach of night. The archbiſhop of Canterbury, and the chancellor, who had taken refuge in the tower, being informed of the ſituation of affairs, drew up, during the night, an act of amneſty, which was privately diſperſed among the rebels. This had ſuch an effect, that in the morning Cade found himſelf abandoned by his followers; and retreating to Rocheſter, was obliged to fly alone into the woods. A price being ſet on his head by proclamation, he was diſcovered and ſlain by one Alexander Eden; who, in recompenſe for this ſervice, was made governor of Dover caſtle.

207 Duke of York ſuſpected by the court.

The court now began to entertain ſuſpicions that the inſurrection of John Cade had not happened merely in conſequence of his own machinations and ambition, but that he had been inſtigated thereto by the duke of York, who, as we have already ſeen, pretended a right to the crown. As he was about this time expected to return from Ireland, and a report took place that he was now to aſſert his ſuppoſed right by force of arms, orders were iſſued in the king's name to deny him entrance into England. This was prevented by his appearing with no more than his ordinary attendants; but though he thus eſcaped the danger for the preſent, he inſtantly ſaw the neceſſity of proceeding in ſupport of his claim. His partizans were inſtructed to diſtinguiſh between his right by ſucceſſion and by the laws of the kingdom. The adherents of Lancaſter maintained, that though the advancement of Henry IV. might be looked upon as irregular, yet it was founded upon general conſent; or, even allowing it to have been at firſt invalid, it had now been for a long time eſtabliſhed, and acquired ſolidity of conſequence; nor could the right of ſucceſſion at any rate be pleaded for the purpoſe of overthrowing the general peace and tranquillity of the kingdom. The principles of liberty as well as the maxims of true policy had been injured by the houſe of York; while the public were bound to thoſe of Lancaſter, no leſs by political than moral duty, in conſequence of the oaths of fealty that had been ſo often ſworn to them; the duke of York himſelf having repeatedly ſworn allegiance to them, and thus indirectly renounced thoſe claims which he now brought forward to diſturb the public tranquillity. On the part of the duke of York, it was replied, that the good of the people required the maintenance of order in the ſucceſſion of princes; that, by adhering conſtantly to this rule, a number of inconveniences would be prevented which muſt otherwiſe enſue; and though that order had been broken through in the caſe of Henry IV. it was never too late to remedy any pernicious precedent. It would indeed be a great encouragement to uſurpers, if the immediate poſſeſſion of power, or their continuance in it for a few years, could convert them into legal princes; and the people muſt be in a very miſerable ſituation, if all reſtraints on violence and ambition were taken off, and full liberty given to every innovator to make what attempts he pleaſed. They did not indeed deny that time might confer ſolidity on a government originally founded in uſurpation; but a very long courſe of years was not only required for this purpoſe, but a total extinction of thoſe who had any juſt title. The depoſition of Richard II. and advancement of Henry IV. were not legal acts, but the effects of mere levity in the people; in which the houſe of York had acquieſced from neceſſity, and not from any belief of the juſtice of their cauſe; nor could this be ever interpreted into any renunciation of their pretenſions; neither could the reſtoration of the true order of ſucceſſion be conſidered as an encouragement to rebellion and turbulence, but the correction of a former abuſe by which rebellion had been encouraged. Beſides, the original title of Henry IV. was founded entirely on preſent convenience; and even this was now entirely ſhifted to the houſe of York. The preſent prince was evidently incapable of governing the kingdom by reaſon of his imbecility; ſo that every thing was governed either by corrupt miniſters or an imperious queen, who engaged the nation in foreign connections entirely contrary to its intereſts; while, on the other hand, the true heir of the crown was a prince of approved judgment and experience, and a native of England, who, by his reſtoration, would undoubtedly correct all thoſe abuſes of which there was now ſuch juſt reaſon to complain.

208 Arguments for and againſt the houſes of York and Lancaſter.

In this diſpute it was evident that the houſe of York had the better in point of argument: nevertheleſs, as a prince of the houſe of Lancaſter was in immediate poſſeſſion of the throne, and could by no means be charged with any crime, the cauſe of the former was leſs generally intereſting; eſpecially as it muſt always have been uncertain, *à priori*, whether the duke of York would have governed any better than King Henry. After his return from Ireland, however, the former uſed all his power and influence to foment the diſcontents which had for ſome time prevailed in the kingdom; and the conduct of the next parliament manifeſted the ſucceſs of his intrigues. A violent attack was made upon ſuch noblemen as were known to be moſt in favour with the king. The houſe of commons preſented a petition againſt the duke of Somerſet, the ducheſs of Suffolk, the biſhop of Cheſter, Lord Dudley, and ſeveral others of inferior rank; praying not only that the king would remove them from his council, but that he would prohibit them from coming within twelve miles of the court. Henry, not daring to refuſe this petition altogether, conſented to baniſh all thoſe of inferior rank, whom the commons had ſpecified, but only for a year; and this too on condition that he had no uſe for their aſſiſtance in quelling any rebellion. But he rejected a bill for attainting the late duke of Suffolk, and propoſed ſome other meaſures which ſeemed to militate againſt the court, though it had paſſed both the houſe of lords and the houſe of commons.

209 The duke of York foments diſſenſions between the king and parliament.

Encouraged by this diſagreement between Henry

England.

and his parliament, the duke of York raiſed an army of 10,000 men, with whom he marched towards London, demanding a reformation in matters of government, and the removal of the duke of Somerſet. This firſt enterpriſe, however, proved unſucceſsful; the gates of the city were ſhut againſt him, and he was purſued by the king at the head of a ſuperior army. On this he retired into Kent; and as there was a number of his own friends in the army of the king, a conference took place, in which Richard ſtill inſiſted upon the removal of the duke of Somerſet, and his ſubmitting to be tried in parliament. This requeſt, was in appearance complied with, and Somerſet arreſted: the duke of York was then perſuaded to wait upon the king in his royal pavilion; but, on repeating his charge againſt the duke, he was ſurpriſed to ſee the latter come out from behind the curtain, and offer to maintain his innocence. Richard perceiving that he had not ſufficient intereſt to ruin his adverſary, pretended to be ſatisfied, and retired to his ſeat at Wigmore in Wales; and during the time he reſided there, a better opportunity was given him of accompliſhing his deſigns than he could have hoped for. The king fell into a kind of lethargic diſorder, which increaſed his natural imbecility to ſuch a degree, that he could no longer retain a ſhadow of royalty. Richard now had intereſt enough to get himſelf appointed protector, with power to hold parliaments at pleaſure; with which high office he was no ſooner inveſted, than he turned out all the Lancaſtrian party from their offices, and ſent the duke of Somerſet to the tower; but on the recovery of the king, which happened in no long time after, he himſelf was diſmiſſed from his employment, the duke of Somerſet releaſed, and the adminiſtration once more put into his hands. On this the duke of York levied an army, merely as he pretended, to enforce the reformation of government and the removal of the duke of Somerſet. Thus Henry, though ſore againſt his will, was obliged to face him in the field. A battle enſued at St Alban's; in which the royaliſts were defeated, and the duke of Somerſet, the chief partiſan of their cauſe, killed in the action. The king himſelf was wounded, and took ſhelter in a cottage near the field of battle; where he was taken priſoner, but was afterwards treated with great reſpect and kindneſs by the duke of York.

210 Richard raiſes an army;

211 But is obliged to retire.

212 He is appointed protector in conſequence of the king's illneſs.

213 Is depoſed and levies an army.

214 Hiſtory of the civil war between Henry and the duke of York.

Henry, though he was now only a priſoner treated with the forms of royalty, was nevertheleſs pleaſed with his ſituation; but his queen, a woman of a bold and maſculine ſpirit, could not bear to have only the appearance of authority, while others enjoyed all the real power. She therefore excited the king once more to aſſert his right by force of arms; and after ſeveral manœuvres, the duke of York was obliged to retire from court. A negotiation for peace was at firſt ſet on foot, but the mutual diſtruſts of both parties ſoon broke it off. The armies met at Bloreheath on the borders of Staffordſhire, on the 23d of September 1459; and the Yorkiſts at firſt gained ſome advantages. But when a more general engagement was about to enſue, a body of veterans who ſerved under the duke of York deſerted to the king; and this ſo intimidated the duke's party, that they ſeparated the next day without ſtriking a blow. The duke of York fled to Ireland; and the earl of Warwick, one of his ableſt and beſt ſupporters, eſcaped to Calais, with the government of which he had been entruſted during the late protectorſhip. England.

The York party, though thus in appearance ſuppreſſed, only waited a favourable opportunity of retrieving their affairs. Nor was this opportunity long wanting. Warwick having met with ſome ſucceſſes at ſea, landed in Kent; and being there joined by other barons, marched up to London amidſt the acclamations of the people. The city immediately opened its gates to him, and he ſoon found himſelf in a condition to face the royal army. An engagement enſued at Northampton on the 10th of July 1460; in which the royaliſts were entirely defeated, and the king again taken priſoner. The duke of York then openly laid claim to the crown; and on this occaſion the firſt inſtance of a ſpirit of national liberty is ſaid to have appeared in the houſe of lords. The cauſe of Henry and the duke of York was ſolemnly debated; and the latter, though a conqueror, did not abſolutely gain his cauſe. It was determined that Henry ſhould poſſeſs the throne during his life; and that the duke of York ſhould be appointed his ſucceſſor, to the utter excluſion of the prince of Wales, who was then a child.

Though the royal party now ſeemed deſtitute of every reſource, the queen ſtill retained her intrepidity. She fled into Wales, where ſhe endeavoured to raiſe another army. The northern barons, provoked at the ſouthern ones for ſettling the government and ſucceſſion to the crown without their conſent, ſoon furniſhed her with an army of 20,000 men. Another battle was fought near Wakefield Green, on the 24th of December 1460. The Yorkiſts were defeated, and the duke himſelf was killed in the action. His head was afterwards cut off by the queen's orders, and fixed on one of the gates of York, with a paper-crown, in deriſion of his pretended title. His ſon the earl of Rutland, a youth of 17, was taken priſoner, and killed in cold blood by Lord Clifford, in revenge for his father's death, who had fallen in the battle of St Alban's.

215 Duke of York killed.

After this victory, Margaret marched towards London, in order to ſet the king at liberty; but the earl of Warwick, who now put himſelf at the head of the Yorkiſts, led about the captive king, in order to give a ſanction to his proceedings. He engaged the queen's forces at St Alban's; but through the treachery of Lord Lovelace, who deſerted during the heat of the engagement with a conſiderable body of forces, Warwick was defeated, and the king fell once more into the hands of his own party.

The ſubmiſſion of the city of London ſeemed now to be the only thing wanting to complete the queen's ſucceſs; but Warwick had ſecured it in his intereſts, and the citizens refuſed to open their gates to the queen. In the mean time, young Edward, eldeſt ſon of the late duke of York, put himſelf at the head of his father's party. He was now in the bloom of youth, remarkable for the beauty of his perſon and his bravery, and was a great favourite of the people. He defeated Jaſper Tudor earl of Pembroke, at Mortimer's croſs in Herefordſhire. The earl himſelf was taken priſoner, and immediately beheaded by Edward's orders.

England.

216 Edward IV.

ders. After this, he advanced to London; and being joined by the remainder of Warwick's army, he ſoon obliged Margaret to retire, entered the city amidſt the acclamations of the people, and was crowned king on the 5th of March 1461.

Nothwithſtanding all her misfortunes, however, Margaret ſtill continued undaunted. She retired to the north, where ſhe was ſoon joined by ſuch numbers, that her army amounted to 60,000 men. She was oppoſed by young Edward and Warwick at the head of 40,000; and both armies met near Touton in the county of York, on the 29th of March 1461. A bloody battle enſued, in which the queen's army was totally defeated; and as Edward, prompted by his natural cruelty, had ordered no quarter to be given, 40,000 of the Lancaſtrians were ſlain in the field or in the purſuit. Edward is ſaid to have gained this victory by means of a violent ſtorm of ſnow, which blew full in the face of the queen's army, and ſo blinded them that they could ſcarcely make any uſe of their arms. After this diſaſter the queen fled to Scotland with her huſband and ſon; and notwithſtanding all the misfortunes ſhe had already met with, reſolved once more to enter England at the head of 5000 men granted her by the king of France. But even here ſhe was attended by her uſual bad fortune. Her little fleet was diſperſed by a tempeſt, and ſhe herſelf eſcaped with the utmoſt difficulty by entering the mouth of the Tweed. Soon after, a defeat, which her few forces ſuſtained at Hexham, ſeemed to render her cauſe entirely deſperate; and the cruelties practiſed upon all her adherents rendered it very dangerous to befriend her.

217 Affairs of the queen totally ruined.

218 Adventures of the king and queen.

By theſe repeated misfortunes the houſe of Lancaſter was ſo effectually ruined, that Margaret was obliged to ſeparate from her huſband, and both of them to ſhift for themſelves the beſt way they could. The king was ſtill protected by ſome of his friends, who conveyed him to Lancaſhire, where he remained in ſafety for a twelvemonth; but being at laſt diſcovered, he was thrown into the Tower and kept cloſe priſoner. The queen fled with her ſon to a foreſt, where ſhe was ſet upon by robbers, who ſtripped her of her rings and jewels, treating her otherwiſe with the utmoſt indignity. A quarrel which happened among them about the diviſion of the ſpoil afforded her an opportunity of eſcaping from their hands into another part of the foreſt, where ſhe wandered for ſome time without knowing what to do. At laſt, when quite ſpent with hunger and fatigue, ſhe ſaw a robber coming up to her with a drawn ſword in his hand. Finding it altogether impoſſible to eſcape, ſhe ſuddenly took the reſolution of putting herſelf under his protection. Advancing towards him, therefore, and preſenting the young prince, "Here (ſays ſhe), my friend, I commit to your care the ſafety of your king's ſon." This addreſs ſo much ſurpriſed the robber, that, inſtead of offering her any injury, he profeſſed himſelf entirely devoted to her ſervice. After living for ſome time concealed in the foreſt, ſhe was at laſt conducted to the ſea-ſide, where ſhe found a ſhip which conveyed her to Flanders. On her arrival there, ſhe went to her father's houſe, who, though very poor, gave her ſuch entertainment as he could afford; and in this retreat ſhe ſtaid ſome years in expectation of finding an opportunity of retrieving her affairs.

219 The queen retires to Flanders.

Edward, in the mean time, thinking himſelf ſecurely fixed on the throne, gave a looſe to his favourite paſſions; one of which was an immoderate love of women. To divert him from this, the earl of Warwick, to whom he was indebted for his crown, adviſed him to marry. Edward conſented, and ſent him over to the continent to negotiate a match with the princeſs of Savoy. The negotiation proved ſucceſsful; but, in the mean time, the king had privately eſpouſed Elizabeth Woodville, daughter to Sir Philip Woodville, who had married the ducheſs of Bedford after the death of her firſt huſband. Edward had employed his arts of ſeduction againſt this lady in vain before he married her; but unfortunately the match was concluded juſt at the time that the earl of Warwick had proved ſucceſsful in his negotiation with the princeſs of Savoy. The miniſter therefore returned full of indignation againſt his ſovereign: and Edward, forgetting how great cauſe he had to be offended, determined to remove him entirely from his councils. Warwick was likewiſe diſguſted by the favour ſhown to the queen's party; which, though certainly a piece of very commendable policy in Edward, was entirely diſagreeable to the ambitious diſpoſition of that nobleman. A plan of revenge was therefore thought of; and a moſt powerful combination was formed againſt Edward: to accompliſh which, Warwick not only employed his own influence, which was very extenſive, but likewiſe that of the duke of Clarence, Edward's brother, to whom the earl had allied himſelf by giving him his daughter in marriage; after which he perſuaded him to embrace his cauſe. Some circumſtances which took place about this time alſo favoured the ſcheme. The inhabitants about St Leonard's in Yorkſhire complained, that the duties levied for that inſtitution, and which had been originally appointed for pious purpoſes, were ſecreted by the managers, who refuſed to contribute their part. As the clergy were concerned in this affair, they attempted to ſilence their antagoniſts by eccleſiaſtical fulminations againſt them; upon which the latter took up arms, fell upon the officers of the hoſpital, and having maſſacred them, proceeded towards York, to the number of 15,000. In the firſt ſkirmiſh, they had the misfortune to loſe their leader, who was inſtantly executed. The rebels, however, ſtill continued in arms, and in a ſhort time appeared in ſuch numbers as to become formidable to government. Henry earl of Pembroke was ſent againſt them with a body of 5000 men; and having taken Sir Henry Nevil, one of the leaders of the inſurgents, priſoner, inſtantly put him to death; but this was ſoon revenged by a ſimilar execution on himſelf, who happened to be defeated and taken priſoner a ſhort time after. This defeat had been occaſioned by a diſagreement betwixt the earls of Pembroke and Devonſhire; in conſequence of which the latter had gone off with his troops, leaving Pembroke to ſhift for himſelf the beſt way he could. The king, enraged at this, cauſed Devonſhire to be executed in a like ſummary manner: but this was of no ſervice to his cauſe; a new body of inſurgents appeared under Sir Robert Welles, ſon to a nobleman of that name. The latter, in order to ſecure himſelf from all ſuſpicions of diſloyalty, fled to a monaſtery; but he was ſoon enticed from thence and put to death by the inſidious promiſes of King Edward, whoſe treachery was equal to his cruelty. His

England.

220 Warwick diſguſted by Edward.

221 The king's brother joins in the conſpiracy againſt him.

222 An inſurrection in Yorkſhire.

England. son soon after shared the same fate, being defeated and taken prisoner by Edward, who instantly ordered him to be beheaded, along with Sir Thomas Launde and other persons of distinction.

223 Warwick and Clarence join the insurgents.

Notwithstanding such an appearance of a general insurrection, the king had so little suspicion of the loyalty of Warwick and Clarence, that he employed them in raising troops to quell the insurgents. Instead of executing their commission with fidelity, however, they joined the malcontents with all the forces they could raise; but being quite disconcerted by the defeat and death of Sir Robert Welles, they retired to Lancashire, in hopes of being joined by Lord Stanley, who had married the earl of Warwick's sister. Being disappointed in this, they were obliged to disband their army, and fly into Devonshire, whence they set sail for Calais. Upon their arrival on the continent, matters seemed not to be much mended: the deputy-governor, whom Warwick had left, refused him admittance; nor would he even allow the duchess of Clarence to land, though she had been delivered of a son on board only a very few days before, and was at that time extremely ill. Being well acquainted, however, with the uncertainty of the affairs of England at that time, he afterwards made an apology to Warwick for this behaviour. The latter pretended to be easily reconciled; but immediately left the place, having seized some Flemish vessels which he found lying in the neighbourhood.

224 Reconciliation betwixt Warwick and the queen.

As a very close alliance subsisted between Warwick and the duke of Burgundy, the king of France became uneasy; and therefore, as soon as the earl landed in his dominions, received him with the greatest marks of esteem. The reconciliation betwixt him and the unfortunate Queen Margaret now seemed to be natural, though, considering all circumstances, this must have formerly appeared in a manner impossible. The earl's father had been put to death by the orders of Margaret; and Warwick, in return, had twice taken prisoner King Henry, banished the queen, and put to death almost all their faithful adherents. By the mediation of the French monarch, however, all differences were accommodated. A fleet was prepared to reconduct them to England; and seizing a proper opportunity, they landed at Dartmouth with a small body of troops, while Edward was in the north suppressing an insurrection which had lately appeared there. Warwick was attended with astonishing success on his arrival in England, and in less than six days saw himself at the head of 60,000 men. Edward was now obliged in his turn to fly the kingdom. Having narrowly escaped an attempt made upon his person by the marquis of Montague, he embarked on board a small fleet which lay off Lynn in Norfolk. While at sea, he was chased by some ships belonging to the Hans Towns that were then at war both with France and England; but at length, having escaped all dangers, Edward landed safely in Holland, where he met with but an indifferent reception from the duke of Burgundy, with whom he had lately entered into an alliance.

225 He lands in England.

Warwick in the mean time advanced to London, and once more released and placed on the throne the miserable king Henry VI. A parliament was called, which very solemnly confirmed Henry's title to the throne, and Warwick himself was dignified by the people with the title of the *king-maker*. All the attainders of the Lancastrians were reversed; and every England. one was restored who had lost either honours or fortune by his former adherence to Henry's cause. All the adherents of Edward fled to the continent, or took shelter in monasteries, where they were protected by the ecclesiastical privileges. But Edward's party was not yet destroyed. After an absence of nine months, being seconded by a small body of troops granted him by the duke of Burgundy, he made a descent at Ravenspur in Yorkshire. At first he met with little success; but his army increasing on his march, he was soon in a condition to appear before the capital, which immediately opened its gates.

The unfortunate Henry was thus again plucked from the throne; and the hopes of Warwick were almost totally blasted by the defection of Clarence, Edward's brother. Nothing now remained but to come to an engagement as soon as possible. Warwick knew his forces to be inferior to those of Edward, but placed great dependence on his own generalship. He therefore advanced to Barnet, within ten miles of London, where he resolved to wait the coming of Edward. The latter soon came up with him, and on the 14th of April 1471 a most obstinate and bloody battle was fought. Edward, according to custom, had ordered no quarter to be given; and obtained the victory through a mistake of a body of Warwick's forces, who fell with fury on their own party instead of the enemy. The earl himself was slain, together with his brother, and 10,000 of his bravest followers.

The queen was just then returned with her son from France, where she had been soliciting supplies. She had scarce time to refresh herself from the fatigues of the voyage, when she received the fatal news of the death of Warwick, and the total destruction of her party. All her resolution was not able to support her under such a terrible disaster. Her grief now for the first time, it is said, manifested itself by her tears; and she immediately took sanctuary in the abbey of Beaulieu in Hampshire. Here she still found some friends willing to assist her. Tudor earl of Pembroke, Courtney earl of Devonshire, the lords Wenlock and St John, with some other men of rank, encouraged her yet to hope for success, and promised to stand by her to the last. On this assurance, she resumed her courage; and advancing through the counties of Devon, Somerset, and Gloucester, increased her army every day. At last, however, she was overtaken by Edward with his victorious army at Tewkesbury, on the banks of the Severn. The queen's army was totally defeated; the earl of Devonshire and Lord Wenlock were killed in the field; the duke of Somerset, and about 20 other persons of distinction, who had taken shelter in a church, were surrounded, dragged out, and immediately beheaded; about 3000 of their party fell in battle, and the army was entirely dispersed. Queen Margaret and her son were taken prisoners, and brought to the king, who asked the prince in an insulting manner, how he dared to invade his dominions? The young prince replied, that he came thither to claim his just inheritance; upon which Edward struck him on the face with his gauntlet. The dukes of Clarence and Gloucester, Lord Hastings, and Sir Thomas Gray, taking this blow as a signal for farther violence, hurried the prince into the next apartment, and there dispatched him with their

226 Total destruction of the queen's party.

England. their daggers. Margaret was thrown into the tower along with her huſband Henry, who expired in that confinement a few days after. It was univerſally believed that he was murdered by the duke of Glouceſter, though of this there was no direct evidence. Margaret was ranſomed by the king of France for 50,000 crowns, and died a few years after in a moſt miſerable ſituation.

Edward being now freed from all his enemies, began to inflict puniſhment on thoſe who had formerly appeared againſt him. Among the cruelties he committed, that on his brother the duke of Clarence was the moſt remarkable. The king happening to be one day hunting in the park of Thomas Burdet, a ſervant of the duke, killed a white buck which was a great favourite of the owner. Burdet, vexed at the loſs, broke out into a paſſion, and wiſhed the horns of the deer in the belly of the perſon who adviſed the king to that inſult. For this exclamation Burdet was tried for his life, and executed at Tyburn. The duke of Clarence exclaimed againſt the iniquity of this ſentence; upon which he was arraigned before the houſe of peers, found guilty, and condemned to death. The only favour granted him was to have the choice of his death; and his choice was a very ſingular one, namely, to be drowned in a butt of Malmſey wine; which was accordingly done.—The reſt of this reign affords little elſe than a hiſtory of the king's amours. Among his many miſtreſſes, Jane Shore was the moſt remarkable; (ſee SHORE). The king died on the 9th of April 1482, in the 42d year of his age, and 21ſt of his reign, counting from his firſt aſſuming the crown. Beſides five daughters, he left two ſons; Edward prince of Wales, his ſucceſſor, then in his 13th year; and Richard duke of York in his 9th.

228 Edward V. On the death of Edward IV. the kingdom was divided into new factions. The queen's family, which, during the laſt reign, had come into power, was become obnoxious to the old nobility, who conſidered them as their inferiors. The king had endeavoured to prevent theſe animoſities from coming to a height, by deſiring on his death-bed that his brother Richard duke of Glouceſter ſhould be entruſted with the regency; and recommended peace and unanimity during the minority of his ſon. But the king was no ſooner dead than the former reſentment between theſe parties broke out with violence; and the duke of Glouceſter, who was endued with almoſt every bad quality, reſolved to profit by their contentions. His firſt ſtep was to get himſelf declared protector of the realm; and having arreſted the earl of Rivers, the king's uncle and guardian, he met young Edward in his way from Ludlow caſtle, where the late king had reſided during the latter part of his reign, and reſpectfully offered to conduct him to London. Having thus ſecured the perſon of the king, he next got poſſeſſion of his brother's perſon alſo. The queen had retired with this child into Weſtminſter abbey; and it was not without extreme regret that ſhe delivered him up at the interceſſion of the primate and archbiſhop of York.

229 Duke of Glouceſter declared protector.

In a few days after Glouceſter had made himſelf maſter of the perſons of the two princes, he had them confined in the tower, under pretence of guarding them from danger; and ſoon after ſpread reports of their illegitimacy, and by pretended obſtacles put off the young king's coronation. Lord Stanley firſt began to ſuſpect his deſigns; and communicated his ſuſpicions to Lord Haſtings, who had long been firmly attached to the king's family. Lord Haſtings would not at firſt give credit to this ſurmiſe; but he very ſoon had a fatal proof of the truth of what had been communicated to him. On the 13th of June 1483, he was hurried out of the council-room in the tower by Glouceſter's order, and beheaded on a log of timber. The ſoldiers who carried him off made a buſtle as though an attempt had been made to reſcue him, and one of them diſcharged a blow at Lord Stanley's head with a poleaxe; but he happily eſcaped by ſhrinking under the table. The ſame day were executed the Earl Rivers, and ſome others, who had committed no other crime than being faithful to the young king. England.

The protector now thought he might with ſafety lay claim to the throne. He had previouſly gained over the duke of Buckingham, a nobleman of great influence among the people. He uſed his utmoſt endeavours to inſpire the people with a notion of the illegitimate birth of the late king, and conſequently of his children. Dr Shaw, a popular preacher, was alſo hired to harangue the people to the ſame purpoſe from St Paul's croſs. Having expatiated on the incontinence of the queen, and the illegality of the young king's title, he then made a panegyric on the virtues of the protector. "It is the protector (continued he) who carries in his face the image of virtue, and the marks of a true deſcent. He alone can reſtore the loſt glory and honour of the nation." It was hoped that upon this occaſion ſome of the populace would have cried out, "Long live King Richard!" but the audience remaining ſilent, the duke of Buckingham undertook in his turn to perſuade them. Having expatiated on the calamities of the laſt reign and the illegitimacy of the preſent race, he told the people, that he ſaw only one method of warding off the miſeries which threatened the ſtate, which was by electing the protector; but he ſeemed apprehenſive that he would never be prevailed upon to accept a crown accompanied with ſuch difficulty and danger. He next aſked his auditors, whether they would have the protector for their king? but was mortified to find that a total ſilence enſued. The mayor, who was in the ſecret, willing to relieve him in this embarraſſed ſituation, obſerved, that the citizens were not accuſtomed to be harangued by a man of his quality, and would only give an anſwer to their recorder. This officer, therefore, repeated the duke's ſpeech; but the people continuing ſtill ſilent, "This is ſtrange obſtinacy (cried the duke): we only require of you, in plain terms, to declare, whether or not you will have the duke of Glouceſter for your king; as the lords and commons have ſufficient power without your concurrence?" At this, ſome of the meaneſt apprentices, incited by the ſervants of the protector and Buckingham, raiſed a feeble cry of "God ſave King Richard!" The mob at the door repeated the cry; and throwing up their caps into the air, cried out, "A Richard! A Richard!" After this farce was acted, Buckingham, on the 24th of June 1483, waited on Richard with offers of the crown: but the protector, with hypocritical modeſty, at firſt declined the offer; till being told, that the people, in caſe of his refuſal, muſt look out for one that would be more compliant, he

England. he accepted the government of England and France, with a reſolution, as he ſaid, to defend the one and ſubdue the other.

230 Richard III. The firſt ſtep taken by the new king was to ſend orders to Sir Robert Brackenbury governor of the tower, to put the young princes to death. But this he refuſed; and ſubmiſſively anſwered that he knew not how to embrue his hands in innocent blood. A fit inſtrument for this purpoſe, however, was not long wanting. Sir James Tyrrel readily undertook the office; and Brackenbury was ordered to reſign the keys to him for one night. Tyrrel chooſing three aſſociates, Slater, Deighton, and Foreſt, came in the night-time to the door of the chamber where the princes were lodged; and ſending in the aſſaſſins, bid them execute their commiſſion, while he himſelf ſtaid without. They found the young princes in bed, and fallen into a ſound ſleep. The aſſaſſins ſmothered them with the bolſter and pillows; after which they ſhowed their naked bodies to Tyrrel, who ordered them to be buried at the ſtair-foot under a heap of ſtones (c).

231 Edward V. and his brother murdered.

Richard having thus ſecured himſelf on the throne by the moſt iniquitous methods, attempted to ſtrengthen his intereſt by foreign alliances, and procuring the favour of the clergy at home by great indulgences; but he found his power threatened from a quarter where he leaſt expected an attack. The duke of Buckingham, who had been ſo inſtrumental in raiſing him to the throne, did not think himſelf properly rewarded. He made a demand of ſome confiſcated lands in Hereford, to which his family had an ancient claim. Richard either reluctantly complied with his requeſt, or only granted it in part; ſo that a coolneſs ſoon enſued between them, and in a little time Buckingham came to a reſolution of dethroning the monarch whom he had juſt raiſed. For ſome time he remained in doubt, whether he ſhould aſſume the crown himſelf or ſet up another. At length he determined on the latter; and reſolved to declare for Henry earl of Richmond, who was at that time an exile in Britanny, and was conſidered as the only ſurviving branch of the houſe of Lancaſter. He was one of thoſe who had the good fortune to eſcape the numerous maſſacres of the former reigns; but as he was a deſcendant of John of Gaunt by the female line, he was for that reaſon obnoxious to thoſe in power. He had long lived in exile, and was once delivered over to the ambaſſadors of Edward IV. who were preparing to carry him to England; when the duke of Britanny, who delivered him, repented of what he had done, and took him from the ambaſſadors juſt as they were carrying him on ſhipboard. His right to the crown by ſucceſſion was very doubtful: but the cruel behaviour of Richard inclined the people in general greatly to favour him; and, to give an additional ſtrength to his title, a match was projected betwixt him and the princeſs Elizabeth, the eldeſt daughter of Edward IV. which, by uniting the two rival families, would put an end to thoſe diſſenſions which had ſo long filled the kingdom with bloodſhed and confuſion. Richard, in the mean time, from ſome reaſons which have not been particularized by hiſtorians, began to entertain doubts of the fidelity of Buckingham, and determined to cut him off. For this purpoſe he ſent for him to court: but Buckingham, inſtead of obeying the ſummons, fled into Wales, where he raiſed a conſiderable army, and forthwith ſet out to the eaſtward with a deſign to invade England. Richard haſtened to meet him with what forces he could raiſe; but the march of Buckingham being retarded by a moſt uncommon inundation of the Severn which laſted 10 days, his troops were ſo diſheartened at this event, that they almoſt all deſerted him. The duke was therefore obliged to fly in diſtreſs, and Richard inſtantly ſet a price upon his head. Buckingham was now obliged to truſt his life in the hands of an old ſervant of his own, named *Baniſter;* but this man, tempted by the greatneſs of the reward, betrayed him to the ſheriff of Shropſhire, by whom he was ſeized and conducted to Richard at Saliſbury, who cauſed him to be executed without delay. The earl of Richmond, in the mean time, had ſet ſail from St Maloes with a body of 5000 men: but after his arrival in England, receiving the diſagreeable news of Buckingham's misfortune, he ſet ſail again for Bretagne; while Richard, emboldened by the bad ſucceſs of his enemies, determined to confirm his title to the throne by calling a parliament, which till this time he had not ventured to do. At preſent matters were ſo circumſtanced, that the parliament had no other reſource than to comply with his deſires, and acknowledge his right to the crown. An act was paſſed confirming the illegitimacy of Edward's children; and an attainder was alſo confirmed againſt the earl of Richmond; the duties of tonnage and poundage were granted to the king for life; and his only ſon Edward, then about 12 years of age, was created prince of Wales. In return for theſe conceſſions, Richard paſſed ſeveral popular laws, particularly againſt the extorting of money by benevolences, and ſome others calculated to gain the good will of the oppoſite party. He paid his court alſo to the queen-dowager with ſuch aſſiduity and ſucceſs, that ſhe left her ſanctuary, and put herſelf and her daughters into his hands. The ambition and cruelty of this man indeed are ſaid to have extinguiſhed every ſentiment of natural affection as well as humanity. He had married Anne, the ſecond daughter of the earl of Warwick, and widow of Edward prince of Wales, whom he himſelf had murdered; but having born him but one ſon, who died about this time, he conſidered her as an invincible obſtacle to the accompliſhment of his deſires; for which reaſon it was thought he put an end to her life by poiſon: and as he knew that the projected match between the earl of Richmond and the princeſs Elizabeth could only make the rivalſhip of the former any way formidable, he reſolved to obtain a diſpenſation

232 Buckingham determines to ſupport the claim of the earl of Richmond to the throne.

233 He takes up arms, but is abandoned by his army and put to death.

234 Richmond lands in England, but is obliged to return.

235 Richard's title confirmed by parliament.

England.

(c) Theſe circumſtances are ſaid to have been confeſſed in the ſucceeding reign, though the perpetrators eſcaped puniſhment. The bodies of the two princes were ſought for without any ſucceſs under the reign of Henry VII. but in the time of Charles II. the bones of two perſons anſwering to their age were found in the ſpot where they were ſaid to have been buried; which, being ſuppoſed to be the remains of theſe two unfortunate youths, they were buried under a marble monument in Weſtminſter abbey.

England. tion from the pope for marrying her himſelf. The queen-dowager is even ſaid to have come into this ſcheme, with a view to recover her power; but the princeſs herſelf always rejected his addreſſes with abhorrence. The refuſal of the princeſs occaſioned no ſmall perplexity in Richard; and before he could determine on any proper method of accompliſhing his purpoſe, he received news of Richmond's preparations for landing in England. Theſe being ſoon accompliſhed, Henry ſet ſail from Harfleur in Normandy, and landed without oppoſition, on the 17th of Auguſt 1485, at Milford haven in Wales. Richard, in the mean time, not knowing where the invaſion was to take place, had poſted himſelf at Nottingham; which being almoſt in the centre of the kingdom, was therefore proper for reſiſting any invader. Sir Rice ap Thomas and Sir Walter Herbert were commiſſioned by Richard to oppoſe his rival in Wales; but the former immediately deſerted to him, and the latter made but a very feeble reſiſtance. Richard inſtantly reſolved to meet his antagoniſt, and to riſk every thing on the event of a battle. Richmond, though he had not above 6000 men, and the king near double that number, did not decline the combat; being chiefly encouraged by the promiſes of Lord Stanley to join him with a body of 7000 men, and with whom he hovered at a little diſtance from the intended field of battle, ſeemingly indetermined to join either ſide.

236 Richmond lands in England a ſecond time.

237 Richard defeated and killed.

The king having commanded his army to form themſelves in order of battle, intruſted the van to the duke of Norfolk, while he himſelf, with the crown on his head, took the command of the main body. Lord Stanley in the mean time poſted himſelf on one flank between the two armies, while his brother Sir William took his ſtation directly oppoſite. As his intention of either joining the enemy or keeping neutral during the time of the engagement was now far from being doubtful, Richard ſent him orders to join the main body; which not being complied with, the tyrant determined to put to death Stanley's ſon, who had been left with him as a pledge of his father's fidelity. He was perſuaded, however, to defer the execution till after the engagement, that Stanley might thereby be induced to delay his purpoſe in joining the enemy. This, however did not anſwer the expectation. Soon after the engagement was begun, Stanley deſerted Richard's party, and joining Richmond, entirely decided the fortune of the day. The tyrant perceiving his ſituation to be quite deſperate, and ſeeing his rival at no great diſtance from him, drove up againſt him with fury, in hopes that either Henry's death or his own would decide the victory between them. He killed Sir William Brandon the earl's ſtandard-bearer; he diſmounted Sir John Cheyney; and was within reach of Richmond, when Sir William Stanley breaking in with his troops, Richard was ſurrounded and overwhelmed by numbers. His body was found in the field, covered with dead enemies, and beſmeared with blood. It was thrown careleſsly acroſs a horſe, carried to Leiceſter, amidſt the ſhouts of inſulting ſpectators, and interred in the Gray-Friars church of that place.

The uſurper's crown being found on the field of battle, was placed on the head of the conqueror, while the whole army cried out, "Long live King Henry!" Two days after the battle, Henry gave orders to confine Edward Plantagenet earl of Warwick, and ſon of the unfortunate duke of Clarence; and to releaſe the princeſs Elizabeth, who had been confined in the Tower. He then advanced by ſlow and gradual marches to the city of London, where he was received with the greateſt demonſtrations of joy. He was crowned king of England on the 30th of October 1485; and to heighten the ſplendor on that occaſion, he beſtowed the rank of knights-banneret on 12 perſons, and conferred peerages on three. Jaſper earl of Pembroke, his uncle, he created duke of Bedford; Thomas Lord Stanley his father-in-law, earl of Derby; and Edward Courteney, earl of Devonſhire. At the coronation likewiſe appeared a new inſtitution, which the king had eſtabliſhed for perſonal ſecurity as well as pomp; a band of 50 archers, who were denominated Yeomen of the Guard. But leſt the people ſhould take umbrage at this ſtep, as if it implied a diffidence of his ſubjects, he declared the inſtitution to be perpetual. The ceremony of the coronation was performed by Cardinal Bourchier archbiſhop of Canterbury.—On the 18th of January 1486, he was married to the princeſs Elizabeth; and his marriage was celebrated at London with greater appearance of joy than either his firſt entry or his coronation had been. Henry remarked, with much diſpleaſure, this general favour borne to the houſe of York; and the ſuſpicions ariſing from it, not only diſturbed his tranquillity during the whole of his reign, but bred diſguſt towards his conſort herſelf, and poiſoned all his domeſtic enjoyments.

England. 238 Henry VII

The reign of Henry VII. was for ſeveral years diſturbed by plots and inſurrections. The people, by a long courſe of civil war, had become ſo turbulent and factious, that no governor could rule, nor could any king pleaſe them. The violent animoſity expreſſed by this monarch, however, againſt the houſe of York, may juſtly be conſidered as one of the cauſes of the extreme proneneſs to rebellion manifeſted by his ſubjects. Inſtead of endeavouring to conciliate the affection of the oppoſite party, he always ſtrove to quell them by abſolute force and violence. For this purpoſe he took a journey, ſoon after his acceſſion, to the north of England, where the Yorkiſts were very numerous: hoping to get the better of them by his preſence. In his journey thither, he received intelligence of an inſurrection againſt him by Viſcount Lovel, with Sir Henry Stafford and Thomas his brother, who had raiſed an army, and were marching to beſiege the city of Worceſter, while Lovel approached to aſſiſt them with a body of three or four thouſand men. They were diſperſed, however, by the offer of a general pardon; which induced Lovel to withdraw from his troops, who were thereupon obliged to ſubmit to the king's mercy. The Staffords took ſanctuary in the church of Colnham near Abingdon; but as it was found that this church had not the privilege of protecting rebels, they were taken from thence: the elder was executed at Tyburn; but the younger, pleading that he had been miſled by his brother, received a pardon.

239 His reign diſturbed by frequent rebellions

240 Lovel and Stafford's inſurrection ſuppreſſed

This ſucceſs was ſoon after followed by the birth of a prince; whom Henry named in honour of the celebrated King Arthur, who is ſaid to have been the direct anceſtor of the houſe of Tudor. All this ſucceſs, however, as well as the general ſatisfaction which the birth of a prince deſcended from the houſes both of

241 Prince Arthur born.

England. York and Lancaſter neceſſarily occaſioned, were not ſufficient to reconcile the hearts of the Engliſh to their ſovereign. His extreme ſeverity towards the houſe of York ſtill continued; and unfortunately this was much more beloved by the generality of the nation than that of Lancaſter. Many of the Yorkiſts had been treated with great cruelty, and deprived of their fortunes under pretence of treaſon; a general reſumption had likewiſe been made of the grants made by the princes of the houſe of York. It was likewiſe univerſally believed that the queen herſelf met with harſh treatment, on account of her being one of that unfortunate houſe; and from all theſe circumſtances it was not unreaſonably imagined that his enmity was inveterate and invincible. Hence, notwithſtanding his politic and vigorous adminiſtration, people made no ſcruple of openly expreſſing their diſapprobation of his conduct and government; and one rebellion ſeemed to be extinguiſhed only to give birth to another. The king had, at the commencement of his reign, confined the duke of Clarence's ſon, as has already been mentioned. This unfortunate youth, who had obtained the title of the earl of Warwick, was, through long confinement, entirely unacquainted with the affairs of the world. Simple as he was, however, he was now made uſe of to diſturb the public tranquillity. The queen-dowager was with great reaſon ſuſpected to be at the bottom of this conſpiracy; but not chooſing to interfere openly in the matter herſelf, ſhe employed one Simon a prieſt of Oxford to execute her purpoſes. This man caſt his eyes upon one Lambert Simnel, a baker's ſon in the ſame place, a youth of only 15 years of age; but who, from his graceful appearance and accompliſhments, ſeemed proper for perſonating a man of quality. A report had been ſpread among the people, that Richard duke of York, ſecond ſon of Edward IV. had ſecretly made his eſcape from the cruelty of his uncle, and lay ſomewhere concealed in England. Simon had at firſt inſtructed his pupil to aſſume that name, which he found to be much the object of public affection; but hearing afterwards a new report, that Warwick had eſcaped from the Tower, and obſerving that this news was attended with no leſs general ſatisfaction, he changed the plan of his impoſture, and made Simnel perſonate that unfortunate prince. The pliant youth was therefore directed by his inſtructor to talk upon many occurrences, as happening to him in the court of Edward. But as the impoſtor was not calculated to bear cloſe examination, he was removed to Ireland: and ſo well had he profited by the leſſons given him, that he no ſooner preſented himſelf to the earl of Kildare the deputy, claiming his protection as the unfortunate earl of Warwick, than he began to conſult with ſeveral other noblemen with regard to him. Theſe expreſſed even a ſtronger belief in Simnel's ſtory than the deputy himſelf had done; and in proportion as the ſtory was ſpread abroad, the more credit it obtained. The impoſtor was lodged in the caſtle of Dublin; the inhabitants univerſally took an oath of allegiance to him, as the true deſcendant of the Plantagenets; he was crowned with a diadem taken from the ſtatue of the bleſſed virgin, and proclaimed king by the title of Edward VI.; and the whole kingdom followed the example of the capital.

242 Diſcontents of the people.

243 Impoſture of Lambert Simnel.

Such an unexpected event alarmed Henry ſo much, that he would have gone over to Ireland on purpoſe to quell the rebellion in perſon, had he not been afraid of the machinations of the queen-dowager in his abſence. To prevent any thing of this kind, it was reſolved to confine her for life in a monaſtery; under pretence, however, that it was done on account of her having formerly delivered up the princeſs her daughter to King Richard. The queen murmured againſt the ſeverity of her treatment; but the king perſiſted in his reſolution, and ſhe remained in confinement till the time of her death, which happened ſome years after.

England.

244 The queen-dowager confined.

The next meaſure was to ſhow Warwick to the people. He was taken from the Tower, and led through the principal ſtreets of London; after which he was conducted in ſolemn proceſſion to St Paul's, where great numbers were aſſembled to ſee him. Still, however, they proceeded in Dublin to honour their pretended monarch; and he was crowned with great ſolemnity in the preſence of the earl of Kildare, the chancellor, and the other officers of ſtate. At laſt being furniſhed by the ducheſs of Burgundy with a body of 2000 veteran Germans under the command of Martin Swart, a brave and experienced officer, he reſolved to invade England. He landed in Lancaſhire, from whence he marched to York, expecting that the country people would riſe and join him on his march. But in this he was deceived: the people were unwilling to join a body of foreigners; and were beſides kept in awe by the great reputation of Henry. Lord Lincoln, therefore, who commanded the rebel army, determined to bring the matter to a ſpeedy iſſue. Accordingly he met the royal army at Stoke in the county of Nottingham. An obſtinate engagement enſued, but at length King Henry obtained a complete victory. Lord Lincoln, with 4000 private men, periſhed in the battle; and Simnel with his tutor Simon were taken priſoners. Simon being a prieſt, could not be tried by the civil power, and was only committed to cloſe confinement. Simnel was pardoned, and made a ſcullion in the king's kitchen, whence he was afterwards advanced to the rank of falconer, in which employment he died.

Henry being now freed from all danger from that quarter, determined to take ample vengeance on his enemies. For this purpoſe he took a journey into the north; but though he found many delinquents, his natural avarice prompted him to exact heavy fines from them rather than to put them to death. His proceedings, however, were extremely arbitrary; the criminals being tried, not by the ordinary judges, but either by commiſſioners appointed for the occaſion, or ſuffering puniſhment by ſentence of a court-martial. Having thus fully eſtabliſhed his authority as far as it could be done by ſuppreſſing and puniſhing domeſtic enemies, he next determined to recommend himſelf to his ſubjects by a report of his military diſpoſition; hoping, that by undertaking, or pretending to undertake, ſome martial enterpriſes, he would thus gain the favour of a people naturally turbulent, and unaccuſtomed to live long at peace with their neighbours. He certainly had not, however, the leaſt intention of proſecuting foreign conqueſts; though, to pleaſe the people, he frequently gave out that he deſigned to invade France, and lay waſte the whole country, rather than not recover his continental poſſeſſions. Under theſe pretences, particularly that of aſſiſting the Bretons, whom the king

245 Henry puniſhes his enemies.

246 Pretends a deſire of atchieving martial exploits

king of France had lately subdued, and who had applied to him for relief, he persuaded his parliament to grant him a considerable supply; but this involved him in some difficulties. The counties of Durham and York, who had always been discontented with Henry's government, and still farther provoked by the oppressions under which they had laboured after the extinction of Simnel's rebellion, opposed the commissioners sent by the king to levy the tax. The latter applied to the earl of Northumberland, requesting his advice and assistance in the execution of their office; but instead of being able to enforce the levying of the tax, he himself was attacked and put to death by the insurgents. This act of violence committed by themselves, seemed to render the insurgents desperate, so that without more ado they prepared to resist the royal power, under the conduct of one Sir John Egremond; but in this ill-conducted and precipitate scheme they met with no success. Henry instantly levied a considerable force, which he committed to the charge of the earl of Surrey; by whom the rebels were quickly defeated, and one of their leaders taken prisoner. Sir John Egremond fled to the duchess of Burgundy, who afforded him protection.

247 Obtains a subsidy on pretence of assisting the inhabitants of Bretagne.

248 An insurrection suppressed.

Thus Henry obtained the subsidy which he had solicited under pretence of invading France, though he would willingly have avoided any expence in preparations for that purpose in order to keep the money in his possession; but as the Bretons had applied to him for assistance, and their distresses became every day more urgent, he found himself obliged to attempt something. With this view he set sail for Calais with an army of 25,000 foot and 1600 horse, of which he gave the command to the duke of Bedford and the earl of Oxford: but notwithstanding this apparent hostile disposition, negotiations for peace had been secretly begun, and commissioners even appointed to consider of the terms, three months before King Henry set out for the continent. As the love of money was the prevailing passion of the English monarch, and the possession of Bretagne was a great object to France, an accommodation soon took place betwixt the contending parties. The king of France engaged to pay Henry near 200,000l. as a reimbursement for the expences of his expedition, and stipulated at the same time to pay him and his heirs an annual pension of 25,000 crowns more.

249 Henry makes a feigned invasion of France.

250 Obtains a sum of money and a annual pension.

Thus the authority of Henry seemed to be so firmly established, as to leave no reason to dread any rival in time to come; but still he found himself mistaken. The duchess of Burgundy, resenting the depression of her family, and exasperated by her frequent miscarriages in the attempts already made, resolved to make a final effort against Henry, whom she greatly hated. For this purpose she propagated a report that her nephew Richard Plantagenet, duke of York, had escaped from the tower where his elder brother was murdered, and that he still lay somewhere concealed. Finding this report eagerly received, she soon found a young man who assumed both his name and character. The person chosen to act this part was the son of one Osbeck, or Warbeck, a converted Jew, who had been in England during the reign of Edward IV. His name was *Peter*; but it had been corrupted after the Flemish manner into *Peterkin*, or *Perkin*. It was by some believed, that Edward, among his other amorous adventures, had a secret correspondence with Warbeck's wife, which might account for the great similarity of features between Perkin and that monarch. The duchess of Burgundy found this youth entirely suited to her purposes. The lessons she gave him were easily learned and strongly retained. His graceful air, his courtly address, his easy manners, and elegant conversation, were capable of imposing upon all but those who were privy to the imposture. The kingdom of Ireland was pitched upon for Perkin's first appearance, as it had been before for that of Simnel. He landed at Cork; and immediately assuming the name of *Richard Plantagenet*, was followed by great numbers of credulous people. He wrote letters to the earls of Desmond and Kildare, inviting them to join his party; he dispersed everywhere the strange intelligence of his escape from his uncle Richard's cruelty; and his story meeting with general credit, he soon became an object of the public favour. All those who were disgusted with the king, prepared to join Perkin; but particularly those who formerly were Henry's favourites, and had contributed to place him on the throne. These, thinking their services had not been sufficiently repaid, now became heads of the conspiracy. Their attempts, however, were all frustrated by the vigilance of the king, and most of the conspirators of any note were publicly executed.

251 Imposture of Perkin Warbeck.

Perkin finding it was in vain to attempt any thing in England, went to the court of James IV. of Scotland. Here he was received with great cordiality; and James carried his confidence in him so far, that he even gave him in marriage Lady Catherine Gordon, daughter to the earl of Huntley, and a near kinswoman of his own. But when he attempted to set him on the throne of England, he found himself totally disappointed; and on the conclusion of peace between the two kingdoms, Perkin was obliged to leave Scotland. From thence he went to Flanders; and meeting with but a cool reception there, he resolved to try the affections of the people of Cornwall, who had lately risen against the king on account of a new tax which had been levied upon them. On his first appearance, Perkin was joined by about 3000 of these people, with which force he laid siege to Exeter. Henry, however, having marched against him with a considerable army, Perkin's heart failed him, though his followers now amounted to 7000; and he took shelter in a monastery. His wife fell into the conqueror's hands; who placed her in a respectable situation near the queen's person, with a suitable pension, which she enjoyed till her death. Perkin being persuaded to deliver himself into the king's hand, was compelled to sign a confession of his former life and conduct; but this was so defective and contradictory, that very little regard was paid to it. His life was granted him; though he was still detained in custody, and keepers were appointed to watch his conduct. From these, however, he broke loose; and flying to the sanctuary of Shyne, put himself into the prior's hands. He was once more prevailed upon to trust himself in the king's hands, and was committed to the tower; but having here entered into a correspondence with the earl of Warwick in order to make their escape, both of them were condemned and executed.

To Henry VII. in a great measure, is owing the

England. present civilized ſtate of the Engliſh nation. He had all along two points principally in view; the one to depreſs the nobility and clergy, and the other to exalt and humanize the populace. In the feudal times every nobleman was poſſeſſed of a certain number of vaſſals, over whom he had, by various methods, acquired an almoſt abſolute power; and, therefore, upon every ſlight diſguſt, he was able to influence them to join him in his revolt or diſobedience. Henry conſidered, that the giving of his barons a power to ſell their eſtates, which were before unalienable, muſt greatly weaken their intereſt. This liberty therefore he gave them; and it proved highly pleaſing to the commons, nor was it diſagreeable to the nobles themſelves. His next ſcheme was to prevent their giving liveries to many hundreds of their dependents, who were thus kept like the ſoldiers of a ſtanding army to be ready at the command of their lord. By an act paſſed in this reign, none but menial ſervants were allowed to wear a livery; and this law was enforced under ſevere penalties.

[251] Engliſh nation civilized by Henry.

With the clergy, Henry was not ſo ſucceſsful. The number of criminals of all kinds who found protection in monaſteries and other places appointed for religious worſhip, ſeemed to indicate little leſs than an abſolute toleration of all kinds of vice. Henry uſed all his intereſt with the pope to get theſe ſanctuaries aboliſhed, but to no purpoſe. All that he could procure was, that if thieves, murderers, or robbers, regiſtered as ſanctuary men, ſhould ſally out and commit freſh offences, and retreat again, in ſuch caſes they might be taken out of the ſanctuary and delivered up to juſtice.

In 1500, the king's eldeſt ſon Arthur was married to the Infanta Catharine of Spain, which marriage had been projected and negotiated ſeven years. But the prince dying in a few months after marriage, the princeſs was obliged to marry his younger brother Henry, who was created prince of Wales in his room. Henry himſelf made all the oppoſition which a youth of 12 years of age is capable of: but as the king perſiſted in his reſolution, the marriage was by the pope's diſpenſation ſhortly after ſolemnized.—In the latter part of this king's reign, his economy, which had always been exact, degenerated into avarice, and he oppreſſed the people in a very arbitrary manner. He had two miniſters, Empſon and Dudley, perfectly qualified to ſecond his avaricious intentions. They were both lawyers, and uſually committed to priſon by indictment ſuch perſons as they intended to oppreſs; from whence they ſeldom got free but by paying heavy fines, which were called mitigations and compoſitions: but by degrees the very forms of law were omitted; and they determined in a ſummary way upon the properties of the ſubjects, and confiſcated their effects to the royal treaſury.—Henry VII. died of the gout in his ſtomach, in the year 1509, having lived 52 years, and reigned 23; and was ſucceeded by his ſon Henry VIII. In Henry VII.'s reign was built a large ſhip of war called the *Great Harry*, which coſt 14,000l. This was, properly ſpeaking, the firſt ſhip in the Engliſh navy. Before this period, when the king wanted a fleet, he had no other expedient than to hire ſhips from the merchants.

252 Death of Henry VII.

253 Henry VIII.

Henry VIII. aſcended the throne when he was about 18 years of age, and had almoſt every advantage which a prince can have on his acceſſion. He had a well-ſtored treaſury, and indiſputed title, and was at peace with all the powers in Europe. Commerce and arts had been ſome time introduced into England, where they met with a favourable reception. The young prince himſelf was beautiful in his perſon, expert in all polite exerciſes, open and liberal in his air, and loved by all his ſubjects. The old king, who was himſelf a ſcholar, had inſtructed him in all the learning of the times, ſo that he was an adept in ſchool-divinity before the age of 18. England.

All theſe advantages, however, ſeemed to have been loſt upon the new king. Being deſtitute of a good heart and ſolid underſtanding, he proved a tyrant. Being always actuated, not by reaſon, but the paſſion which happened to be uppermoſt in his mind, he behaved in the moſt abſurd and contradictory manner; and however fortunate ſome of his meaſures proved at laſt, it is impoſſible that either his motives, or the means he took for the accompliſhment of his purpoſes, can be approved of by any good man.

One of Henry's firſt actions in his royal capacity was to puniſh Empſon and Dudley, who were obnoxious to the populace on account of their having been the inſtruments of the late king's rapacity. As they could not be impeached merely on account of their having ſtrictly executed the will of the king, they were accuſed of having entered into a treaſonable conſpiracy, and of having deſigned to ſeize by force the adminiſtration of government; and though nothing could be more improbable than ſuch a charge, the general prejudice againſt them was ſo great, that they were both condemned and executed.

In 1510, the king entered into a league with Pope Julius II. and Ferdinand king of Spain, againſt Louis XII. of France. In this alliance Henry was the only diſintereſted perſon. He expected nothing beſides the glory which he hoped would attend his arms, and the title of *Moſt Chriſtian King*, which the pope aſſured him would ſoon be taken from the king of France to be conferred upon him. The pope was deſirous of wreſting from Louis ſome valuable provinces which he poſſeſſed in Italy, and Ferdinand was deſirous of ſharing in the ſpoil. Henry ſummoned his parliament; who very readily granted him ſupplies, as he gave out that his deſign was to conquer the kingdom of France, and annex it to the crown of England. It was in vain that one of his old prudent counſellors objected, that conqueſts on the continent would only drain the kingdom without enriching it; and that England, from its ſituation, was not fitted to enjoy extenſive empire. The young king, deaf to all remonſtrances, and hurried away by his military ardour, reſolved immediately to begin the war. But after ſeveral attempts, which were rendered unſucceſsful only by the miſmanagement of thoſe who conducted them, a peace was concluded with France on the 7th of Auguſt 1514.

Henry's arms were attended with more ſucceſs in Scotland; where King James IV. with the greateſt part of the Scots nobility, and 10,000 of the common people, were cut off in the battle of Flowden†. Henry in the mean time, puffed up with his imaginary ſucceſſes againſt France, and his real ones againſt Scotland, †See *Scotland.*

England. land, continued to laviſh his treaſures by expenſive pleaſures, and no leſs expenſive preparations for war. The old miniſters who had been appointed by his father to direct him, were now diſregarded; and the king's confidence was entirely placed in Thomas afterwards Cardinal Wolſey, who ſeconded him in all his favourite purſuits, and who, being the ſon of a private gentleman at Ipſwich, had gradually raiſed himſelf to the firſt employments of the ſtate *. He doth not ſeem to have had many bad qualities beſides his exceſſive pride, which diſguſted all the nobility; but the great ſhare he poſſeſſed in the favour of ſuch an abſolute prince as Henry VIII. put him quite out of the reach of his enemies.

254 Cardinal Wolſey miniſter.

* See *Wolſey*.

255 Arbitrary behaviour of the king.

The king having ſoon exhauſted all the treaſures left him by his father, as well as the ſupplies which he could by fair means obtain from his parliament, applied to Wolſey for new methods of replenithing his coffers. The miniſter's firſt ſcheme was to get a large ſum from the people under the title of *benevolence*; though no title could be more improperly applied, as it was not granted without the greateſt murmurings and complaints. Wolſey even met with oppoſition in the levying of it. In the firſt place, having exacted a conſiderable ſum from the clergy, he next applied himſelf to the houſe of commons; but they only granted him half the ſum he demanded. The miniſter at firſt was highly offended, and deſired to be heard in the houſe; but they replied, that none could be permitted to ſit and argue there except ſuch as were members. Soon after, the king having occaſion for new ſupplies, by Wolſey's advice attempted to procure them by his prerogative alone, without conſulting his parliament. He iſſued out commiſſions to all the counties of England for levying four ſhillings in the pound from the clergy, and three ſhillings and fourpence from the laity. This ſtretch of royal power was ſoon oppoſed by the people, and a general inſurrection ſeemed ready to enſue. Henry endeavoured to pacify them by circular letters; in which he declared, that what he demanded was only by way of benevolence. The city of London, however, ſtill heſitated on the demand; and in ſome parts of the country inſurrections were actually begun. Theſe were happily ſuppreſſed by the duke of Suffolk; but the cardinal loſt ſomewhat of the king's favour on account of the improper advice he had given him. To reinſtate himſelf in his good graces, Wolſey made the king a preſent of a noble palace called *York-place*, at Weſtminſter, aſſuring him that from the firſt he had intended it for the king's uſe. In order to have a pretence for amaſſing more wealth, Wolſey next undertook to found two new colleges at Oxford; and for this purpoſe he received every day freſh grants from the pope and the king. The former imprudently gave him liberty to ſuppreſs ſome monaſteries, and make uſe of their revenues for the erection of his new colleges; but this was a fatal precedent for the pontiff's intereſts, and it taught the king to ſeize on the monaſtic revenues whenever he ſtood in need of money.

For a conſiderable time Wolſey continued to enjoy the king's favour in an extreme degree; and as no monarch was ever more deſpotic than Henry VIII. no miniſter was more powerful than Wolſey. This extraordinary elevation ſerved only to render his fall the more conſpicuous, and himſelf the more miſerable, when it took place: and what was worſe, he had long foreſeen, from what he knew of the king's capricious and obſtinate temper, that it certainly would happen one time or other. The cauſe of his final overthrow was the deſire King Henry began to entertain of having his queen Catharine divorced. The doctrines of the reformation, propagated by Luther in 1517, had gained conſiderable ground in England, and many profeſſed a belief in them, notwithſtanding the ſevere perſecution which had been carried on againſt heretics during ſome of the preceding reigns. The clergy had become ſo exceedingly corrupt, and were immerſed in ſuch monſtrous ignorance, that they were univerſally hated even by their own party; while no regard at all was paid to their deciſions, or rather they were looked upon with the utmoſt abhorrence, by the reformers. Even the papal authority, though ſtill very great, had, in no greater a ſpace of time than ten years (viz. from 1517, when Luther firſt began to attack it, to the preſent year 1527), declined very ſenſibly. The marriage of King Henry, therefore, being looked upon by all parties as in itſelf illegal, and only ſanctified by a diſpenſation from the pope, had been frequently objected to on different occaſions. We are informed by ſome authors, that when Henry VII. betrothed his ſon, at that time only 12 years of age, he evidently ſhowed an intention of taking afterwards a proper opportunity to annul the contract; and that he ordered Prince Henry, as ſoon as he ſhould come of age, to enter a proteſtation againſt the marriage; charging him on his death-bed not to finiſh an alliance ſo unuſual, and liable to ſuch inſuperable objections. Some members of the privy council, particularly Warham the primate, afterwards declared againſt the completion of the marriage; and even after it was completed, ſome incidents which in a ſhort time took place were ſufficient to make him ſenſible of the general ſentiments of the public on that ſubject. The ſtates of Caſtile had oppoſed a marriage betwixt the emperor Charles and the Engliſh princeſs Mary, Henry's daughter, urging among other things the illegitimacy of her birth. The ſame objection afterwards occurred on opening a negotiation with France for a marriage with the duke of Orleans.

England. 256 Cauſe of Wolſey's diſgrace

257 Scruples concerning the legality of Henry's marriage

If theſe accounts are to be depended upon as authentic, we can ſcarce conceive it poſſible but Henry himſelf muſt have been ſomewhat ſtaggered by them; though it is by no means probable that they were his only motives. The queen was ſix years older than the king, her perſonal charms were decayed, and his affection leſſened in proportion. All her children had died in infancy except one daughter, the princeſs Mary above mentioned; and Henry was, or pretended to be, greatly ſtruck with this, as it ſeemed ſomething like the curſe of being childleſs, pronounced in the Moſaic law againſt ſome evil doers. Another point of the utmoſt importance was the ſucceſſion to the crown, which any queſtion concerning the legitimacy of the king's marriage would involve in confuſion. It was alſo ſuppoſed, with great reaſon, that ſhould any obſtacles of this kind occur, the king of Scotland would ſtep in as the next heir, and advance his pretenſions to the crown of England. But above all, it is probable that he was influenced by the love he had now contracted for Anne Boleyn, who had lately been

258 Other reaſons for Henry's deſire of a divorce.

259 He [illegible] Anne Boleyn.

England. been appointed maid of honour to the queen. In this ſtation Henry had frequent opportunities of ſeeing her, and ſoon became deeply enamoured; and finding that his paſſion could not be gratified but by a marriage, it is not to be doubted that he was thus obſtinately ſet upon the divorce; for which purpoſe he ſent his ſecretary to Rome to obtain from Clement a bull for diſſolving his marriage with Catharine. That he might not ſeem to entertain any doubt of the pope's prerogative, he inſiſted only on ſome grounds of nullity in the bull granted by his predeceſſor Julius for the accompliſhment of the marriage. In the preamble to this bull, it had been ſaid, that it was granted only upon the ſolicitation of Henry himſelf; though it was known that he was then a youth under 12 years of age: it was likewiſe aſſerted, that the bull was neceſſary for maintaining the peace between the two crowns; though otherwiſe it is certain that there was no appearance of a quarrel betwixt them. Theſe falſe premiſes ſeemed to afford a very good pretence for diſſolving it; but, as matters then ſtood, the pope was involved in the utmoſt perplexity. Queen Catharine was aunt to the emperor, who had lately made Clement himſelf a priſoner, and whoſe reſentment he ſtill dreaded: and beſides, he could not with any degree of prudence declare the bull of the former pope illicit, as this would give a mortal blow to the doctrine of papal infallibility. On the other hand, Henry was his protector and friend; the dominions of England were the chief reſource from whence his finances were ſupplied; and the king of France, ſome time before, had got a bull of divorce in circumſtances nearly ſimilar. In this exigence he thought the wiſeſt method would be to ſpin out the affair by negotiation; and in the mean time he ſent over a commiſſion to Wolſey, in conjunction with the archbiſhop of Canterbury or any other Engliſh prelate, to examine the validity of the king's marriage and of the former diſpenſation; granting them alſo a proviſional diſpenſation for the king's marriage with any other perſon.

260 Sends to Rome to obtain a divorce.

261 Extreme perplexity of the pope.

The pope's meſſage was laid before the council in England: but they conſidered, that an advice given by the pope in this ſecret manner might very eaſily be diſavowed in public; and that a clandeſtine marriage would totally invalidate the legitimacy of any iſſue the king might have by ſuch a match. In conſequence of this, freſh meſſengers were diſpatched to Rome, and evaſive anſwers returned; the pope never imagining that Henry's paſſion would hold out during the tedious courſe of an eccleſiaſtical controverſy. But in this he was miſtaken. The king of England had been taught to diſpute as well as the pope, and valued himſelf not a little on his knowledge in theology: and to his arguments he added threats; telling him, that the Engliſh were but too well diſpoſed to withdraw from the holy ſee; and that if he continued uncomplying, the whole country would readily follow the example of their monarch, who ſhould always deny obedience to a pontiff that had treated him with ſuch falſehood and duplicity. The king even propoſed to his holineſs whether, if he were not permitted to divorce his preſent queen, he might not have a diſpenſation for having two wives at once?

262 Henry's controverſy with him.

The pope, perceiving the king's eagerneſs, at laſt ſent Cardinal Campegio his legate to London; who with Wolſey, opened a court for trying the legitimacy of the king's marriage with Catharine, and cited the king and queen to appear before them. The trial commenced the 31ſt of May 1529; and both parties preſented themſelves. The king anſwered to his name when called: but the queen, inſtead of anſwering to hers, roſe from her ſeat, and, throwing herſelf at the king's feet, made a very pathetic harangue; which her dignity, her virtue, and misfortunes, rendered ſtill more affecting. She told her huſband, "That ſhe was a ſtranger in his dominions, without protection, without counſel, and without aſſiſtance; expoſed to all the injuſtice which her enemies were pleaſed to impoſe upon her: That ſhe had quitted her native country, without any other reſource than her connections with him and his family; and that, inſtead of ſuffering thence any violence or iniquity, ſhe had been aſſured of having in them a ſafeguard againſt every misfortune: That ſhe had been his wife during 20 years; and would here appeal to himſelf, whether her affectionate ſubmiſſion to his will had not merited other treatment than to be thus, after ſo long a time, thrown from him with indignity: That ſhe was conſcious,—he himſelf was aſſured,—that her virgin honour was yet unſtained when he received her into his bed; and that her connections with his brother had been carried no farther than the mere ceremony of marriage: That their parents, the kings of England and Spain, were eſteemed the wiſeſt princes of their time, and had undoubtedly acted by the beſt advice when they formed the agreement for that marriage, which was now repreſented as ſo criminal and unnatural: And that ſhe acquieſced in their judgment, and would not ſubmit her cauſe to be tried by a court whoſe dependance on her enemies was too viſible ever to allow her any hopes of obtaining from them an equitable or impartial deciſion." Having ſpoken theſe words, the queen roſe, and, making the king a low reverence, left the court; nor would ſhe ever again appear in it. The legate having again ſummoned the queen to appear before them, on her refuſal, declared her contumacious, and the trial proceeded in her abſence. But when the buſineſs ſeemed to be nearly decided, Campegio, on ſome very frivolous pretences, prorogued the court, and at laſt transferred the cauſe before the ſee of Rome.

England. 263 Trial of the king and queen before the pope's legate.

All this time Cardinal Wolſey ſeemed to be in the ſame dilemma with the pope, and indeed much worſe; as he could not boaſt of the ſame independence which his holineſs poſſeſſed. On the one hand, he was very ſolicitous to gratify the king his maſter, who had diſtinguiſhed him by ſo many and extraordinary marks of favour; on the other, he feared to offend the pope, whoſe ſervant he more immediately was, and who likewiſe had power to puniſh his diſobedience. He had long known that this affair was certainly to end in his ruin; and by attempting to pleaſe all parties, he fell under the diſpleaſure of every one; ſo that he was at laſt left without a ſingle friend in the world. The king was diſpleaſed on account of his not entering into his cauſe with the warmth he thought he had reaſon to expect; Anne Boleyn imputed to him the diſappointment of her hopes; while even Queen Catharine and her friends expreſſed the greateſt indignation againſt him on account of the part he had openly taken in the affair of her divorce. In this miſerable ſituation the king

264 Embarraſſment of Cardinal Wolſey.

England. king ſent him a meſſage by the dukes of Norfolk and Suffolk, demanding the great ſeal: the cardinal refuſed to deliver it without a more expreſs warrant; upon which Henry wrote him a letter, and on receipt of this it was inſtantly given up. The ſeal was beſtowed on Sir Thomas More; a man who, beſides elegant literary talents, was poſſeſſed of the higheſt capacity, integrity, and virtue. Wolſey was next commanded to depart from York-place palace which he had built in London; and which, though it belonged to the ſee of York, was now ſeized by the king, and afterwards became the reſidence of the Britiſh ſovereigns, under the name of *Whitehall*. All his furniture and plate, the richneſs of which ſeemed rather proper for a monarch than a ſubject, was ſeized for the king's uſe. He was then commanded to retire to Eſher, a country-ſeat which he poſſeſſed near Hampton court, and there to wait the king's pleaſure. One diſgrace followed another; and his fall was at length completed by a ſummons to London to anſwer a charge of high treaſon. This ſummons he at firſt refuſed to anſwer, as being a cardinal. However, being at length perſuaded, he ſet out on his journey; but was taken ill, and died by the way. See the article WOLSEY.

265 Is diſgraced and proſecuted.

266 All the univerſities of Europe conſulted about the legality of the king's marriage. * See *Cranmer.*

After the death of Wolſey, the king, by the advice of Cranmer *, had the legality of his marriage debated in all the univerſities of Europe; and the votes of theſe were obtained in his favour by dint of money. The diſburſements made on the occaſion have even been preſerved to this day. To a ſubdeacon he gave a crown, to a deacon two crowns, and ſo to the reſt in proportion to the importance of their ſtation or opinion.—Being thus fortified by the opinions of the univerſities, and even of the Jewiſh rabbies (for them alſo he had conſulted), Henry began to think he might ſafely oppoſe the pope himſelf. He began by reviving in parliament an old law againſt the clergy, by which all thoſe who had ſubmitted to the authority of the pope's legate were condemned to ſevere penalties. The clergy, to conciliate the king's favour, were obliged to pay a fine of 118,000 pounds. A confeſſion was likewiſe extorted from them, that the king, and not the pope, was the ſupreme head of the church and clergy of England. An act was ſoon after paſſed againſt levying the firſt-fruits, or a year's rent of all the biſhoprics that fell vacant. After this the king privately married his beloved Anne Boleyn; and ſhe proving with child ſoon after marriage, he publicly owned her for his wife, and paſſed with her through London, with a greater magnificence than had ever been known before. The ſtreets were ſtrewed with flowers, the walls of the houſes hung with tapeſtry, and a univerſal joy ſeemed to be diffuſed among the people. The unfortunate queen Catharine, perceiving all further oppoſition to be vain, retired to Amphthill near Dunſtable, where ſhe continued the reſt of her days in privacy and peace. Her marriage with Henry was at laſt declared invalid, but not till after the latter had been married to Anne Boleyn, though this declaration ought undoubtedly to have preceded it. See BOLEYN.

267 Henry's final quarrel with the pope.

The pope was no ſooner informed of theſe proceedings, than he paſſed a ſentence, declaring Catharine to be the king's only lawful wife; requiring him to take her again, and denouncing his cenſures againſt him in caſe of a refuſal. Henry, on the other hand, knowing that his ſubjects were entirely at his command, reſolved to ſeparate totally from the church of Rome. In the year 1534, he was declared head of the church by parliament; the authority of the pope was completely aboliſhed in England; all tributes formerly paid to the holy ſee were declared illegal; and the king was entruſted with the collation to all eccleſiaſtical benefices. The nation came into the king's meaſures with joy, and took an oath called the *oath of ſupremacy*; all the credit which the popes had maintained over England for ages was now overthrown at once; and none ſeemed to repine at the change, except thoſe who were immediately intereſted by their dependence on Rome. England. 268 Is declared head of the church.

But though the king thus ſeparated from the church of Rome, he by no means adhered to the doctrines of Luther which had been lately publiſhed. He had written a book againſt this celebrated reformer, which the pope pretended greatly to admire; and honoured King Henry, on its account, with the title of "Defender of the faith." This character he ſeemed to be determined to maintain, and therefore perſecuted the reformers moſt violently. Many were burnt for denying the popiſh doctrines, and ſome alſo were executed for maintaining the ſupremacy of the pope. The courtiers knew not which ſide to take, as both the new and old religions were equally perſecuted; and as both parties equally courted the favour of the king, he was by that means enabled to aſſume an abſolute authority over the nation. As the monks had all along ſhown the greateſt reſiſtance to Henry's eccleſiaſtical character, he reſolved at once to deprive them of the power of injuring him. He accordingly empowered Cromwell, ſecretary of ſtate, to ſend commiſſioners into the ſeveral counties of England to inſpect the monaſteries; and to report, with rigorous exactneſs, the conduct and deportment of ſuch as were found there. This employment was readily undertaken by ſome creatures of the court, whoſe names were Layton, London, Price, Gage, Petre, and Belaſis. They are ſaid to have diſcovered monſtrous diſorders in many of the religious houſes; whole convents of women abandoned to all manner of lewdneſs; friars accomplices in their crimes; pious frauds everywhere committed, to increaſe the devotion and liberality of the people; and cruel and inveterate factions maintained between the inhabitants. Thus a general horror was excited againſt theſe communities; and therefore the king, in 1536, ſuppreſſed the leſſer monaſteries, amounting to 376 in number. Their revenues, computed at 32,000 pounds a-year, were confiſcated to the king's uſe; beſides their plate and other goods, computed at 100,000 pounds more. In 1538, the greater monaſteries alſo were demoliſhed. The better to reconcile the people to this great innovation, ſtories were publiſhed, perhaps with aggravations, of the deteſtable lives which the friars led in their convents. The relicks alſo, and other objects of ſuperſtitious veneration, were now brought forth, and became objects of deriſion to the reformers. A great number of theſe are enumerated by Proteſtant writers; ſuch as the parings of St Edmund's toes; ſome of the coals that roaſted St Laurence; the girdle of the virgin Mary, ſhewn in no fewer than eleven different places; two or three heads of St Urſula; the felt of St Thomas of Lancaſter, an infallible cure for the headach; part of St Thomas of Canterbury's ſhirt, much 269 Suppreſſion of the monaſteries.

England. much reverenced among big-bellied women; ſome relicks, an excellent preſervative againſt rain, others againſt weeds in corn, &c. Some impoſtures, however, were diſcovered, which diſplayed a little more ingenuity in the contrivance. At Hales in the county of Glouceſter had been ſhown, during ſeveral ages, the blood of Chriſt brought from Jeruſalem. The veneration for this precious relick may eaſily be imagined; but it was attended with a moſt remarkable circumſtance not obſerved in any other relicks. The ſacred blood was not viſible to any one in mortal ſin, even when ſet before him; nor could it be diſcovered till he had performed good works ſufficient for his abſolution. At the diſſolution of the monaſtery, the whole contrivance was diſcovered. Two of the monks who were let into the ſecret, had taken the blood of a duck, which they renewed every week: they put it into a phial, one ſide of which was thin and tranſparent cryſtal, the other thick and opaque. When any rich pilgrim arrived, they were ſure to ſhow him the dark ſide, till maſſes and offerings had expiated his offences; after which they made him happy, by turning the phial. —A miraculous crucifix had been kept at Boxely in Kent, and bore the appellation of the *rood of grace*. The lips, eyes, and head of the image, moved on the approach of its votaries. Helſey biſhop of Rocheſter broke the crucifix at St Paul's croſs, and ſhowed to all the people the ſprings and wheels by which it had been ſecretly moved. A great wooden idol, called *Darvel Gatherin*, was alſo brought to London and cut in pieces: and, by a cruel refinement of vengeance, it was employed as fuel to burn Friar Foreſt; who was puniſhed for denying the king's ſupremacy, and for ſome pretended hereſies. A finger of St Andrew, covered with a thin plate of ſilver, had been pawned for a debt of 40 pounds; but as the king's commiſſioners refuſed to releaſe the pawn, people made themſelves very merry with the poor creditor on account of his ſecurity. On this occaſion alſo was demoliſhed the noted ſhrine of Thomas à Becket, commonly called *St Thomas of Canterbury* *. The riches of it were inconceivable: when broken down, the gold with which it was adorned filled two large cheſts that eight ſtrong men could ſcarcely carry out of the church. The king, on the whole, ſuppreſſed 645 monaſteries, of which 28 had abbots who enjoyed ſeats in parliament. Ninety colleges were demoliſhed in ſeveral counties; 2374 chantries and free chapels, and 110 hoſpitals. The whole revenue of theſe eſtabliſhments amounted to 161,100 pounds.

* See *Becket*.

It is eaſy to imagine the indignation which ſuch an uninterrupted courſe of ſacrilege and violence would occaſion at Rome. In 1535, the king had executed Biſhop Fiſher, who was created a cardinal while in priſon, and Sir Thomas More, for denying or ſpeaking ambiguouſly about his ſupremacy. When this was reported in Italy, numerous libels were publiſhed all over the country, comparing the king of England to Nero, Domitian, Caligula, and the moſt wicked tyrants of antiquity. Clement VII. died about ſix months after he had threatened the king with a ſentence of excommunication; and Paul III. who ſucceeded him in the papal throne, entertained ſome hopes of an accommodation. But Henry was ſo much accuſtomed to domineering, that the quarrel was ſoon rendered totally incurable. The execution of Fiſher was reckoned ſuch a capital injury, that at laſt the pope paſſed all his cenſures againſt the king, citing him and all his adherents to appear in Rome within 90 days, in order to anſwer for their crimes. If they failed, he excommunicated them; deprived the king of his realm; ſubjected the kingdom to an interdict; declared his iſſue by Anne Boleyn illegitimate; diſſolved all leagues which any Catholic princes had made with him; gave his kingdom to any invader; commanded the nobility to take up arms againſt him; freed his ſubjects from all oaths of allegiance; cut off their commerce with foreign ſtates; and declared it lawful for any one to ſeize them, to make ſlaves of their perſons, and to convert their effects to his own uſe. But though theſe cenſures were then paſſed, they were not openly denounced. The pope delayed the publication till he ſhould find an agreement with England totally deſperate, and till the emperor, who was then hard preſſed by the Turks and the Proteſtant princes of Germany, ſhould be in a condition to carry the ſentence into execution. But in 1538, when news arrived at Rome that Henry had proceeded with the monaſteries as above related, the pope was at laſt provoked to publiſh the cenſures againſt him. Libels were again diſperſed, in which he was anew compared to the moſt furious perſecutors of antiquity, and the preference was now given on their ſide. Henry, it was ſaid, had declared war with the dead, whom the Pagans themſelves reſpected; was at open enmity with heaven; and had engaged in profeſſed hoſtility with all the ſaints and angels. Above all, he was reproached with his reſemblance to the emperor Julian, whom (it was ſaid) he imitated in his apoſtaſy and learning, though he fell ſhort of him in his morals. But theſe terrible fulminations had now loſt their effect. Henry had long ago denied the ſupremacy of the pope, and therefore had appealed from him to a general council; but now, when a general council was ſummoned at Mantua, he refuſed to be ſubject to it, becauſe it was called by the pope, and lay entirely under ſubjection to that ſpiritual uſurper. He engaged his clergy to make a declaration to the like purpoſe, and preſcribed to them many other alterations with regard to their ancient tenets and practices. It was expected that the ſpirit of oppoſition to the church of Rome would have at laſt made him fall in with the doctrines of the reformed; but though he had been gradually changing the theological ſyſtem in which he was educated, ever ſince he came to the years of maturity, he was equally poſitive and dogmatical in the few articles he retained, as though the whole fabric had continued entire and unſhaken: and though he ſtood alone in his opinion, the flattery of courtiers had ſo much inflamed his tyrannical arrogance, that he thought himſelf entitled to regulate by his own particular ſtandard the religious faith of the whole nation. The point on which he chiefly reſted his orthodoxy was the moſt abſurd in the whole popiſh doctrine; namely, that of tranſubſtantiation. All departure from this he held to be a damnable error; and nothing, he thought, could be more honourable for him, than, while he broke off all connections with the Roman pontiff, to maintain, in this eſſential article, the purity of the Catholic faith.

England. 270 The king excommunicated.

271 His abſurd and tyrannical conduct.

In 1539, a parliament was called, which met on the 28th day of April. The chancellor opened this parliament

England. parliament by informing the houſe of lords, that it was his majeſty's earneſt deſire to extirpate from his kingdom all diverſity of opinions with regard to religion; and as this enterpriſe was, he owned, difficult and important, he deſired them to chooſe a committee from among themſelves, who might frame certain articles, and communicate them afterwards to parliament. The lords named the vicar-general Cromwell, now created a peer, the archbiſhops of Canterbury and York, the biſhops of Durham, Carliſle, Worceſter, Bath and Wells, Bangor, and Ely. This ſmall committee itſelf was agitated with ſuch diverſity of opinions, that it could come to no concluſion. The duke of Norfolk then moved, that ſince there was no hope of having a report from the committee, the articles of faith propoſed to be eſtabliſhed ſhould be reduced to ſix, and a new committee be appointed to frame an act with regard to them. As this peer was underſtood to ſpeak the king's mind, his motion was immediately complied with; and, after a ſhort prorogation, the bill of the ſix articles, or the *bloody bill*, as the Proteſtants juſtly termed it, was introduced; and having paſſed the two houſes, received the king's aſſent. By this law the doctrine of the real preſence was eſtabliſhed; the communion in one kind; the perpetual obligation of vows of chaſtity; the utility of private maſſes; the celibacy of the clergy; and the neceſſity of auricular confeſſion. The denial of the real preſence ſubjected the perſon to death by fire, and to the ſame forfeiture as in caſes of treaſon; and admitted not the privilege of abjuring: an unheard-of cruelty, unknown even to the inquiſition itſelf. The denial of any of the other articles, even though recanted, was puniſhable by the forfeiture of goods and chattels, and impriſonment during the king's pleaſure: an obſtinate adherence to error, or a relapſe, was adjudged to be felony, and puniſhable by death. The marriage of prieſts was ſubjected to the ſame puniſhment. Their commerce with women was, for the firſt offence, forfeiture and impriſonment; and for the ſecond, death. Abſtaining from confeſſion, and from receiving the euchariſt at the accuſtomed times, ſubjected the perſon to fine, and to impriſonment during the king's pleaſure; and if the criminal perſevered after conviction, he was puniſhable by death and forfeiture, as in caſes of felony. Commiſſioners were to be appointed by the king for inquiring into theſe hereſies and irregular practices, and the criminals were to be tried by a jury.

272 Law of the ſix articles framed.

The parliament having thus ſurrendered their eccleſiaſtical privileges, next proceeded to ſurrender their civil ones alſo. They gave to the king's proclamations the ſame force as to ſtatutes enacted by parliament, and thus by one blow made a total ſubverſion of the Engliſh conſtitution; and to render the matter worſe, if poſſible, they framed this law as if it were only declaratory, and intended to explain the natural extent of the royal authority.—Notwithſtanding this, however, they afterwards pretended to make ſome limitations in the regal power; and they enacted, that no proclamation ſhould deprive any perſon of his lawful poſſeſſions, liberties, inheritances, &c. nor yet infringe any common law or laudable cuſtom of the realm.

As ſoon as the act of the ſix articles had paſſed, the Catholics were extremely vigilant to inform againſt offenders; and, in a ſhort time, no fewer than 500 perſons were thrown into priſon. But ſome of the chief officers of ſtate remonſtrating againſt the cruelty of puniſhing ſuch a number of delinquents, they were all of them ſet at liberty; and ſoon after this, Henry, as if he had reſolved to give each party the advantage by turns, granted every one permiſſion to have a tranſlation of the Bible, which had been newly made, in his family. England.

In 1540, the king again complained to parliament of the great diverſity of religious tenets which prevailed among his ſubjects; a grievance, he affirmed, which ought the leſs to be endured, becauſe the ſcriptures were now publiſhed in England, and ought univerſally to be the ſtandard of belief to mankind. But he had appointed, he ſaid, ſome biſhops and divines to draw up a liſt of tenets; and he was determined that Chriſt and the truth ſhould have the victory; whence he ſeems to have expected more from this new book of his doctors, than had enſued from the publication of the ſcriptures. Cromwell, as vicar-general, alſo made a ſpeech in the upper houſe; and the peers in return told him, that he deſerved to be vicar-general to the univerſe: To ſuch a degree of mean and ſervile ſubmiſſion was the Engliſh parliament at this time reduced.

This year alſo the king ſuppreſſed the only religious order remaining in England; namely, the knights of St John of Jeruſalem, or the *knights of Malta*, as they are commonly called. This order had by their valour done great ſervice to Chriſtendom; and had very much retarded, at Jeruſalem, Rhodes, and Malta, the rapid progreſs of the barbarians. During the general ſurrender of the religious houſes in England, they had obſtinately refuſed to give up their revenues to the king; and Henry who would endure no ſociety that profeſſed obedience to the pope, was obliged to have recourſe to parliament for the diſſolution of this order. Their revenues were large, and formed a conſiderable addition to the acquiſitions which the king had already made. But he had been ſuch a bad economiſt, that, notwithſtanding the immenſe plunder afforded him by the church, he now demanded from parliament a very conſiderable ſupply. The commons, however, though laviſh of the blood of their fellow-ſubjects, were extremely frugal of their money; and it was not without murmuring that the grant could be obtained, even by this abſolute and dreaded monarch. 273 Suppreſſion of the knights of Malta,

The king all this time continued to puniſh with unrelenting ſeverity the Proteſtants who offended againſt the law of the ſix articles, and the Papiſts who denied his ſupremacy; which gave occaſion to a foreigner at that time to ſay, that thoſe who were againſt the pope were burned, and thoſe who were for him were hanged. The king even ſeemed to diſplay in an oſtentatious manner his tyrannical juſtice and impartiality, which reduced both parties to ſubjection. This year he executed three Proteſtants and three Papiſts coupled together. The latter declared, that the moſt grievous part of their puniſhment was the being coupled to ſuch heretical miſcreants as ſuffered with them.

In 1542, Henry proceeded to the further diſſolution of colleges, hoſpitals, and other foundations of that nature. The courtiers had been dealing with the hoſpitals, preſidents and governors to make a ſurrender of their revenues 274 And of many colleges, &c

England. revenues to the king; and they had ſucceeded with eight. But there was an obſtacle to their farther progreſs: it had been provided by the local ſtatutes of moſt of theſe foundations, that no preſident nor any fellows could make ſuch a deed without the unanimous conſent of all the fellows. This conſent would not have been eaſily obtained; but the parliament proceeded in a ſummary manner to annul all theſe ſtatutes: by which means the revenues of thoſe houſes were expoſed to the rapacity of the king and his favourites. Henry alſo now extorted from many biſhops a ſurrender of their chapter-lands; by which means he pillaged the ſees of Canterbury, York, and London, and enriched his favourites with their ſpoils. He engaged the parliament to mitigate the penalties of the ſix articles, as far as regarded the marriage of prieſts, which was now only ſubjected to a forfeiture of goods, chattels, and lands during life: he was ſtill equally bent on maintaining a rigid purity in ſpeculative principles. He had appointed a commiſſion conſiſting of two archbiſhops and ſeveral biſhops of both provinces, together with a conſiderable number of doctors of divinity; and by virtue of his eccleſiaſtical ſupremacy he had charged them to chooſe a religion for his people. Before the commiſſioners, however, had made any progreſs in this arduous undertaking, the parliament had paſſed a law by which they ratified all the tenets which theſe divines ſhould eſtabliſh with the king's conſent; and thus they were not aſhamed of declaring expreſsly that they took their religion upon truſt, and had no other rule either in religious or temporal concerns than the arbitrary will of their maſter. One clauſe of the ſtatute, however, ſeems to favour ſomewhat of the ſpirit of liberty. It was enacted, that the eccleſiaſtical commiſſioners ſhould eſtabliſh nothing repugnant to the laws and ſtatutes of the realm. But in reality this proviſo was inſerted by the king, to ſerve his own purpoſes. By introducing a confuſion and contradiction into the laws, he became more the maſter of every one's life and property; and as the ancient independence of the church ſtill gave him jealouſy, he was well pleaſed, under colour of ſuch a clauſe, to introduce appeals from ſpiritual to civil courts. For the ſame reaſon he would never promulgate a body of canon law; and he encouraged the judges on all occaſions to interpoſe in eccleſiaſtical cauſes, wherever they thought the law or the prerogative concerned. Being thus armed by the authority of parliament, or rather by their acknowledgment of his ſpiritual ſupremacy, the king employed his commiſſioners to ſelect a ſyſtem of tenets for the aſſent and belief of the nation. A ſmall volume was publiſhed, under the title of *The Inſtitution of a Chriſtian Man*, which was received by the convocation, and made the infallible ſtandard of orthodoxy. In this book the points of juſtification, faith, free-will, good works, and grace, were diſcuſſed in a manner ſomewhat favourable to the opinions of the reformers. The ſacraments, which a few years before were only allowed to be three, were now increaſed to ſeven, conformably to the ſentiments of the Catholics. Throughout the whole of this book the king's caprice is very diſcernible; and the book is in reality to be regarded as his compoſition. For Henry, while he made his opinion a rule for the nation, would himſelf ſubmit to no authority whatever; not even to any which he had formerly eſtabliſhed. The

275 Extreme abſurdity of the king's conduct.

ſame year the people had a farther inſtance of the king's inconſiſtency. He ordered a new book to be compoſed, called *The Erudition of a Chriſtian Man;* and without aſking the conſent of the convocation, he publiſhed by his own authority this new model of orthodoxy. He was no leſs poſitive in his new creed than he had been in the old one; but though he required the faith of the nation to veer about at his ſignal, he was particularly careful to inculcate the doctrine of paſſive obedience in all his books, and he was no leſs careful to retain the nation in the practice. England.

But while the king was thus ſpreading his own books among the people, both he and the clergy ſeem to have been very much perplexed with regard to the ſcriptures. A review had been made by the eccleſiaſtical ſynod of the new tranſlation of the Bible; and Biſhop Gardiner had propoſed, that inſtead of employing Engliſh expreſſions throughout, ſeveral Latin words ſhould ſtill be preſerved, becauſe they contained, as he pretended, ſuch peculiar energy and ſignificance, that they had no correſpondent terms in the Engliſh tongue. Among theſe were *eccleſia*, *pœnitentia*, *pontifex*, *contritus*, &c. But as this mixture would appear extremely barbarous, and was plainly calculated for no other purpoſe than to retain the people in their ancient ignorance, the propoſal was rejected. The knowledge of the people, however, ſeemed to be ſtill more dangerous than their ignorance; and the king and parliament, ſoon after the publication of the ſcriptures, retracted the conceſſion which they had formerly made, and prohibited all but gentlemen and merchants to peruſe them. Even that liberty was not granted without an apparent heſitation, and dread of the conſequences. Theſe perſons were allowed to read, *ſo it be done quietly and with good order*. And the preamble to the act ſets forth, "That many ſeditious and ignorant perſons had abuſed the liberty granted them of reading the Bible; and that great diverſity of opinion, animoſities, tumults, and ſchiſms, had been occaſioned by perverting the ſenſe of the ſcriptures." The maſs book alſo paſſed under the king's examination; but little alteration was yet made in it. Some doubtful or fictitious ſaints only were ſtruck out; and the name of the pope was eraſed. The latter precaution was alſo uſed with every new book that was printed, and even every old one that was ſold. The word *pope* was carefully omitted or blotted out; as if that precaution could aboliſh the term from the language, or cauſe the people forget that ſuch a perſon exiſted. About this time alſo, the king prohibited the acting of plays, interludes, and farces, in deriſion of the popiſh ſuperſtitions; which the Proteſtants had been in uſe to practiſe: and this prohibition was in the higheſt degree pleaſing to the Roman Catholics.

In this tyrannical and headſtrong manner Henry proceeded with regard to eccleſiaſtical affairs. In other reſpects his conduct was equally violent. With regard to his domeſtic concerns, hiſtory ſcarce affords his parallel. We have already taken notice of his extreme love for Anne Boleyn, whom he married, contrary even to his own principles, before the marriage with Catharine was diſſolved. His affection for the former was carried to ſuch a height, that he even procured an act excluding from the ſucceſſion the iſſue of Queen Catharine, in favour of the children of Anne

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Anne Boleyn; and failing them to the king's heirs for ever. An oath to this purpoſe was likewiſe enjoined, under penalty of impriſonment during the king's pleaſure, and forfeiture of goods and chattles. All ſlander againſt the king and his new queen or their iſſue was ſubjected to the penalty of treaſon or miſpriſion of treaſon. The reaſon given for this extreme ſeverity toward his own child was, that her mother had obſtinately refuſed to quit the kingdom, notwithſtanding all the methods he could take to induce her to do ſo. The oath was generally taken throughout the kingdom; Sir Thomas More the chancellor, and Fiſher biſhop of Rocheſter, being the only perſons who refuſed; for which both of them were impriſoned, and ſoon after executed. The unfortunate Queen Catharine died, in her retreat at Amphthill, in the year 1536. On her death-bed ſhe wrote a moſt pathetic letter to the king, in which ſhe forgave him all the injuries ſhe had received, and recommended to him in the ſtrongeſt terms their daughter the princeſs Mary. This letter affected Henry ſo much, that he could not read it without tears; but the new queen is ſaid to have exulted in ſuch a manner on hearing of the death of her rival, as was quite inconſiſtent with either decency or humanity. Her triumph, however, was of ſhort duration. Henry had no ſooner poſſeſſed her, ſecure from every diſquieting thought by the death of Queen Catharine, than his paſſion began to decline; and to this her delivery of a dead ſon did not a little contribute; for ſo impetuous and abſurd were his paſſions, and ſuch was his deſire for male iſſue, that the diſappointment in this reſpect alone was ſufficient to alienate his affection from his wife. The levity of her temper, and her extreme gaiety of behaviour, bordering upon licentiouſneſs, as related under the article BOLEYN, alſo gave an opportunity to her enemies of inflaming the king's jealouſy againſt her. The viſcounteſs of Rochford, in particular, a woman of profligate manners, and who was married to the queen's brother, had the cruelty to report to the king that her huſband committed inceſt with his own ſiſter; and, not content with this, ſhe interpreted every inſtance of favour ſhown by her to a man, as proof of a criminal intercourſe between them. At the ſame time it muſt not be forgot, that he who inſiſted on ſuch rigid fidelity from his wives, was himſelf the moſt faithleſs of mankind. He had doubts, it may be allowed, about the legality of his marriage with Queen Catharine, but his doubts were evidently confirmed by the charms of Anne Boleyn. After being ſatiated with the poſſeſſion of her for ſix years, perhaps he really doubted her fidelity; but here again his doubts were confirmed by the beauty of Jane Seymour, with whom he had now fallen in love. It may eaſily be believed, that from this conſideration alone there was no reaſon to hope that ever the unfortunate Anne would be able to exculpate herſelf. Had ſhe really been guilty, her monſter of a huſband might have allowed her to live; but his cruelty was as unbounded and inſatiable as his other perverſe paſſions. She was condemned; and the ſentence pronounced againſt her was, that ſhe ſhould be burned or beheaded at the king's pleaſure. On hearing this dreadful denunciation, ſhe exclaimed, "O Father! O Creator! thou who art the way, the truth, and the life! thou knoweſt that I have not deſerved this fate." She then made the moſt ſolemn proteſtations of innocence before her judges; but theſe, as they had been from the beginning ineffectual, ſo it was not to be ſuppoſed that they could now avail any thing. Anne was beheaded by the executioner of Calais, who was reckoned more expert than any in England; and Henry enjoyed the pleaſure of marrying his beloved Jane Seymour. His ſatisfaction, however, was of no long continuance; for the queen, becoming pregnant immediately after marriage, died in two days after the birth of the child; who being a ſon, was baptized by the name of Edward VI. As this lady had been more beloved by Henry than any of his other wives, his grief for the loſs of her was extreme. However, it did not hinder him from entering very ſoon afterwards into a new matrimonial ſcheme; in which he met with many difficulties. His firſt propoſals were made to the ducheſs dowager of Milan, niece to the emperor and to Catharine his own former queen; but as he had behaved ſo indifferently to the aunt, it is ſcarcely to be ſuppoſed that his addreſſes could prove agreeable to the niece. On this he demanded the ducheſs-dowager of Longueville, daughter of the duke of Guiſe; but on making the propoſal to the French monarch, Francis I. he was informed that the princeſs had been already betrothed to the king of Scotland. Henry, however, would take no refuſal. He had learned that the object of his affection was endowed with many accompliſhments, was very beautiful, and of a large ſize, which laſt property he looked upon to be neceſſary for him who was now become ſomewhat corpulent himſelf. Francis, to prevent any more ſolicitations on this ſubject, ſent the princeſs to Scotland, but at the ſame time made Henry an offer of Mary of Bourbon, daughter of the duke of Vendoſme. This princeſs was rejected by Henry, becauſe he had heard of her being formerly refuſed by the king of Scotland. He was then offered his choice of the two younger ſiſters of the queen of Scotland, both of them being equal in merit as well as ſize to the one whom he had deſired: but Henry, unwilling to truſt to any reports concerning the beauty of theſe ladies, or even to their pictures, propoſed to Francis, that they ſhould have a conference at Calais under pretence of buſineſs, and that the latter ſhould bring with him the two princeſſes of Guiſe with the fineſt ladies of quality in France, that he might make a choice. This indelicate propoſal ſhocked Francis: he returned for anſwer, that he was too much impreſſed with regard for the fair ſex to carry ladies of the firſt quality, like geldings, to a market, to be choſen or rejected according to the humour of the purchaſer. Henry remonſtrated and ſtormed as uſual; but though Francis at this time earneſtly wiſhed to oblige him, he at laſt totally rejected the propoſal. Negotiations were then entered into for a German match; and the princeſs of Cleves was propoſed by Cromwell, on account of the great intereſt her father had with the Proteſtant princes of Germany. Henry had alſo become enamoured of her perſon from a picture of her he had ſeen: but this, though drawn by an eminent artiſt, was unluckily done ſo much to the advantage, that when the negotiation was quite finiſhed, and the bride arrived in England, he loſt all patience, ſwearing that ſhe was a great Flanders mare, and that he could never bear her the ſmalleſt affection. The matter was ſtill worſe, when he found that ſhe could

276 The ſucceſſion ſettled on the children of Anne Boleyn.

277 Indecent behaviour of the new queen on hearing of the death of Catharine.

278 The king's affection declines.

279 She is accuſed of infidelity to the king.

280 Henry's love for Jane Seymour the true cauſe of Anne Boleyn's death.

England.

281 Execution of Anne Boleyn, and ſecond marriage of Henry.

282 Queen Jane dies in child-bed of Edward VI.

283 Extravagant behaviour of the king concerning his fourth marriage.

284 Marriage with Anne of Cleves.

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could speak no language but Dutch, of which he was entirely ignorant. Notwithſtanding all theſe objections, however, he reſolved to complete the marriage, telling Cromwell, that, ſince he had gone ſo far, he muſt now put his neck into the yoke. The reaſon of this was, that the friendſhip of the German princes was now more than ever neceſſary for Henry; and it was ſuppoſed that the affront of ſending the princeſs back to her own country might be reſented. Cromwell, who knew that his own life depended on the event of the matter, was very anxious to learn from the king how he liked his ſpouſe after having paſſed a night with her; but was ſtruck with terror when he replied that he now hated her more than ever; that he was reſolved not to cohabit with her, and even ſuſpected that ſhe was not a virgin; a matter in which he pretended to be a *connoiſſeur*, and about which he was extremely ſcrupulous. In a little time his averſion increaſed to ſuch a degree, that he determined at any rate to get rid of his queen and prime miniſter both at once. Cromwell had long been an object of averſion to the nobility, who hated him on account of his obſcure birth; his father being no other than a blackſmith, though the ſon had obtained the firſt employments in the kingdom. By his office of vicar-general, he had an almoſt abſolute authority over the clergy; he was alſo lord privy-ſeal, lord-chamberlain, and maſter of the wards. He had alſo been inveſted with the order of the garter, and was created earl of Eſſex. This was ſufficient to raiſe the envy of the courtiers: but he had alſo the misfortune to fall under the diſpleaſure of both Proteſtants and Papiſts; the former hating him on account of his concurrence with Henry in their perſecution, and the latter looking upon him as the greateſt enemy of their religion. To theſe unfortunate circumſtances on the part of Cromwell was added the uſual ſituation of Henry himſelf, who had now fallen in love with Catharine Howard, niece to the duke of Norfolk; to enjoy whom, he now determined to divorce Anne of Cleves. By the inſinuations of this lady and her uncle, Cromwell's ruin was accompliſhed; and he was condemned, not only without any trial, but even without examination. The charge was of hereſy and high treaſon; but the inſtances of the latter were quite abſurd and ridiculous. He ſubmitted, however, to his ſentence without murmuring, as knowing that his complaints on this ſubject would be revenged on his ſon. He was terribly mangled by the executioner before his head could be ſtruck off. His death was ſoon followed by the diſſolution of the marriage with the princeſs of Cleves, which was annulled by the conſent of both parties. The princeſs parted from him with great indifference; and accepted of 3000l. a-year as a compenſation. but refuſed to return to her own country after the affront ſhe had received.

285 The marriage annulled, and Cromwell put to death.

286 Henry falls in love with Catharine Howard.

287 Infidelity and death of the new queen.

The king's marriage with Catharine Howard ſoon followed the diſſolution of that with Anne of Cleves; but the event may ſurely be regarded as a providential puniſhment upon this tyrant, whoſe cruelty, luſt, and other bad qualities, can ſcarcely be matched in hiſtory. We have already mentioned his inſinuations againſt the virtue of the unfortunate princeſs of Cleves: theſe were amply repaid by the actual infidelities of his new queen, whom we muſt ſuppoſe he believed to be a pure and perfect virgin at the time he married her. So happy indeed did he imagine himſelf in this new marriage, that he publicly returned thanks for his conjugal felicity, when a moſt unfortunate information concerning the queen's incontinence was given to Cranmer by one of the name of Laſcelles, whoſe ſiſter had been ſervant to the ducheſs-dowager of Norfolk. He not only gave intelligence of her amours before marriage, but affirmed that ſhe had continued the ſame criminal practices ever ſince. Two of her paramours were arreſted, and confeſſed their crimes: the queen herſelf alſo confeſſed guilt before marriage, but denied having ever been falſe to the king's bed; which, however, had very little probability. She was beheaded on Tower-hill, along with the viſcounteſs of Rochford, who had been a confidant in her amours. The latter, as has already been obſerved, was a principal inſtrument in procuring the deſtruction of the unhappy Anne Boleyn, and therefore died unpitied; while the virtuous character of that unfortunate lady received an additional confirmation from the diſcovery of this woman's guilt.

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288 Abſurdity of the king

To ſecure himſelf from any farther diſaſters of this kind, Henry paſſed a moſt extraordinary law, enacting, that any one who ſhould know, or ſtrongly ſuſpect, any guilt in the queen, might, within 20 days, diſcloſe it to the king or council, without incurring the penalty of any former law againſt defaming the queen; though at the ſame time every one was prohibited from ſpreading the matter abroad, or even privately whiſpering it to others. It was alſo enacted, that if the king married any woman who had been incontinent, taking her for a true maid, ſhe ſhould be guilty of treaſon if ſhe did not previouſly reveal her guilt to him.

Theſe laws afforded diverſion to the people, who now ſaid that the king muſt look out for a widow; as no reputed maid would ever be perſuaded to incur the penalty of the ſtatute. This in truth happened to be the caſe at laſt; for about a year after the death of Catharine Howard, he married, for his ſixth wife, Catharine Parr, widow of Nevil Lord Latimer. This lady, being ſomewhat inclined to the doctrines of the reformation, and having the boldneſs to tell her huſband her mind upon the ſubject, had like to have ſhared the fate of the reſt. The furious monarch, incapable of bearing the leaſt contradiction, inſtantly complained to Biſhop Gardiner, who inflamed the quarrel as much as poſſible; ſo that at laſt the king conſented that articles of impeachment ſhould be drawn up againſt her. But theſe were rendered abortive by the prudence and addreſs of the queen, as related under the article PARR.

289 Sixth marriage with Catharine Parr, whom he intends alſo to put to death.

290 Monſtrous cruelty of the king.

All this time Henry had tyrannized over his nobility in the moſt cruel manner. The old counteſs of Saliſbury, the laſt of the houſe of Plantagenet, was executed with circumſtances of great cruelty. She had been condemned, as uſual, without any trial; and when ſhe was brought to the ſcaffold, refuſed to lay her head on the block in obedience to a ſentence, to the juſtice of which ſhe had never conſented. She told the executioner, therefore, that if he would have her head, he muſt win it the beſt way he could; and thus ſhe ran about the ſcaffold, purſued by the executioner,

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tioner, who aimed many fruitleſs blows at her neck before he was able to put an end to her life. Soon after her, the lord Leonard Grey was likewiſe executed for treaſon, but we have very little account of this tranſaction.

291 Attainder of Norfolk and Surry.

The laſt inſtances of the king's injuſtice and cruelty were the duke of Norfolk and his ſon the earl of Surry. The former had ſerved the king with fidelity, and the latter was a young man of the moſt promiſing hopes. His qualifications, however, were no ſecurity againſt the violence of Henry's temper. He had dropped ſome expreſſions of reſentment againſt the king's miniſters, who had diſplaced him from the government of Boulogne; and the whole family had become obnoxious on account of the late queen Catharine Howard. From theſe motives, orders were given to arreſt both the father and ſon; and accordingly they were arreſted both on the ſame day, and confined to the tower. The ducheſs-dowager of Richmond, Surry's own ſiſter, was among the number of his accuſers; and Sir Richard Southwell alſo, his moſt intimate friend, charged him with infidelity to the king. Surry denied the charge, and challenged his accuſer to a ſingle combat. This favour was denied him; and, notwithſtanding his eloquent and ſpirited defence, he was condemned and executed at Tower-hill.—The duke of Norfolk vainly endeavoured to mollify the king by letters and ſubmiſſions. An attainder was found againſt him, though the only crime his accuſers could allege was, that he had once ſaid that the king was ſickly, and could not hold out long; and that the kingdom was likely to be torn between the contending parties of different perſuaſions. Cranmer, though engaged for many years in an oppoſite party to that of Norfolk, and though he had received many and great injuries from him, would have no hand in ſuch an unjuſt proſecution; but retired to his ſeat at Croydon. The death-warrant, however, was made out, and immediately ſent to the lieutenant of the tower; but a period was put to the cruelties and violence of the king by his death, which happened on the 14th of January 1547, the night before Norfolk was to have been executed.

292 Henry dies, and is ſucceeded by Edward VI.

Henry was ſucceeded by his only ſon Edward, a boy of nine years of age. The moſt remarkable tranſactions of his reign are thoſe with regard to religion. The reſtraint which Henry VIII. had laid upon the Proteſtants was now taken off; and they not only maintained their doctrines openly, but ſoon became the prevailing party. Henry had fixed the majority of his ſon at 18 years of age; and, in the mean time, appointed 16 executors of his will, to whom, during the minority, he entruſted the government of the king and kingdom. This will, he imagined, would be obeyed as implicitly after his death as though he had been alive. But the firſt act of the executors was to chooſe the earl of Hertford, afterwards duke of Somerſet, protector of the realm; and in him was lodged all the regal power, together with a privilege of naming whom he pleaſed for his privy council.

293 Reformation completed.

The duke of Somerſet had long been reckoned a ſecret partiſan of the reformers; and, immediately on his elevation to his preſent high dignity, began to expreſs his intention of reforming the abuſes of the ancient religion. Under his direction and that of Cranmer, therefore, the reformation was carried forward and completed. The only perſon of conſequence who oppoſed the reformers was Gardiner biſhop of Wincheſter; and, to the diſgrace of their own principles, the reformers now ſhowed that they could perſecute as ſeverely as the Papiſts had formerly perſecuted them. Gardiner was committed to the Fleet priſon, where he was treated with great ſeverity. He was afterwards ſent to the tower: and having continued there two years, he was commanded to ſubſcribe ſeveral articles, among which was one confeſſing the juſtice of his own impriſonment. To all the articles but this he agreed to ſubſcribe; but that did not give ſatisfaction. He was then committed to cloſe cuſtody; his books and papers were ſeized; all company was denied him, and he was not even permitted the uſe of pen and ink. The biſhops of Chicheſter, Worceſter, and Exeter, were in like manner deprived of their offices; but the biſhops of Llandaff, Saliſbury, and Coventry, eſcaped by ſacrificing the moſt conſiderable ſhare of their revenues. The libraries of Weſtminſter and Oxford were ordered to be ranſacked, and purged of the Romiſh legends, miſſals, and other ſuperſtitious volumes; in which ſearch, great devaſtation was made even in uſeful literature. Many volumes claſped in ſilver were deſtroyed for the ſake of their rich bindings; many of geometry and aſtronomy were ſuppoſed to be magical, and deſtroyed on that account; while the members of the univerſity, unable to put a ſtop to theſe ravages, trembled for their own ſafety.

294 The reformers perſecute the Catholics.

The reformers, however, were not contented with ſeverities of this kind. A commiſſion was granted to the primate and others, to ſearch after all Anabaptiſts, heretics, or contemners of the new liturgy. Among the numbers who were found guilty upon this occaſion, was one Joan Boucher, commonly called *Joan of Kent*; who was ſo very obſtinate, that the commiſſioners could make no impreſſion upon her. She maintained an abſtruſe metaphyſical ſentiment, that Chriſt, as man, was a ſinful man; but, as the Word, he was free from ſin, and could be ſubject to none of the frailties of the fleſh with which he was clothed. For maintaining this doctrine, the poor woman was condemned to be burnt to death as a heretic. The young king, who it ſeems had more ſenſe than his teachers, refuſed at firſt to ſign the death-warrant: but at laſt, being overcome by the importunities of Cranmer, he reluctantly complied; declaring, that if he did wrong, the ſin ſhould be on the head of thoſe who had perſuaded him to it. The primate, after making another unſucceſsful effort to reclaim the woman from her opinions, committed her to the flames. Some time after, one Van Paris, a Dutchman, was condemned to death for Arianiſm. He ſuffered with ſo much ſatisfaction, that he hugged and careſſed the faggots that were conſuming him.

The reſt of this reign affords only the hiſtory of intrigues and cabals of the courtiers one againſt another. The protector was firſt oppoſed by his own brother admiral Sir Thomas Seymour, who had married Catharine Parr the late king's widow. She died ſoon after the marriage; and he then made his addreſſes to the princeſs Elizabeth, who is ſaid not to have been averſe to the match. His brother the duke, who was at that time in the north, being informed of his

England. his ambitious projects, ſpeedily returned, had him attainted of high treaſon, and at laſt condemned and executed. The duke of Somerſet himſelf, however, was ſome time afterwards deprived of his office by Dudley duke of Northumberland; who at laſt found means to get him accuſed of high treaſon, and executed. Not ſatisfied with the office of protector, which he aſſumed on the death of Somerſet, this ambitious nobleman formed a ſcheme of engroſſing the ſovereign power altogether. He repreſented to Edward, who was now in a declining ſtate of health, that his ſiſters Mary and Elizabeth, who were appointed by Henry's will to ſucceed, in failure of direct heirs, to the crown, had both been declared illegitimate by parliament; that the queen of Scots his aunt ſtood excluded by the king's will; and, being an alien alſo, loſt all right of ſucceeding. The three princeſſes being thus excluded, the ſucceſſion naturally devolved to the marchioneſs of Dorſet, eldeſt daughter of the French queen, Henry's ſiſter, who had married the earl of Suffolk after her firſt huſband's death. The next heir to the marchioneſs was Lady Jane Grey, a lady univerſally reſpected, both on account of the charms of her perſon, and the virtues and endowments of her mind. The king, who was accuſtomed to ſubmit to the politic views of this miniſter, agreed to have the ſucceſſion ſubmitted to council, where Northumberland hoped to procure an eaſy concurrence. The judges, however, who were appointed to draw up the king's letters patent for this purpoſe, warmly objected to the meaſure; and gave their reaſons before the council. They begged that a parliament might be ſummoned, both to give it force, and to free its partiſans from danger: they ſaid that the form was invalid, and would not only ſubject the judges who drew it, but every counſellor who ſigned it, to the pains of treaſon. Northumberland could not brook their demurs; he threatened them with his authority, called one of them a *traitor*, and ſaid he would fight with any man in his ſhirt in ſuch a juſt cauſe as that of Lady Jane's ſucceſſion. A method was therefore found out of ſcreening the judges from danger, by granting them the king's pardon for what they ſhould draw up; and at length the patent for changing the ſucceſſion was completed, the princeſſes Mary and Elizabeth were ſet aſide, and the crown ſettled on the heirs of the dutcheſs of Suffolk (for ſhe herſelf was contented to forego her claim.)

295 Lady Jane Gray declared heir to the crown.

For ſome time the king had languiſhed in a conſumption. After this ſettlement of the crown, his health viſibly declined every day, and little hopes were entertained of his recovery. To make matters worſe, his phyſicians were diſmiſſed by Northumberland's advice, and by an order of council; and he was put into the hands of an ignorant old woman, who undertook in a little time to reſtore him to health. After the uſe of her medicines all his bad ſymptoms increaſed to the moſt violent degree. He felt a difficulty of ſpeech and breathing; his pulſe failed, his legs ſwelled, his colour became livid, and many other ſigns of approaching death made their appearance. He expired at Greenwich on the 6th of July 1553, in the 16th year of his age and 7th of his reign.

296 Death of Edward VI.

After the death of King Edward, very little regard was paid to the new patent by which Lady Jane Grey had been declared heir to the throne. The undoubted title of Mary, notwithſtanding the ſcandalous behaviour of her father and his ſervile parliaments, was acknowledged by the whole nation. Northumberland, however, was reſolved to put the late king's will in execution. He therefore carefully concealed the death of Edward, in hopes of ſecuring the perſon of Mary, who by an order of council had been required to attend her brother during his illneſs; but ſhe being informed of his death, immediately prepared to aſſert her right to the crown. Northumberland then, accompanied by the duke of Suffolk, the earl of Pembroke, and ſome other noblemen, ſaluted Lady Jane Grey queen of England. Jane was in a great meaſure ignorant of theſe tranſactions, and it was with the utmoſt difficulty ſhe was perſuaded to accept of the dignity conferred upon her. At laſt ſhe complied, and ſuffered herſelf to be conveyed to the tower, where it was then uſual for the ſovereigns of England to paſs ſome days after their acceſſion. Mary, however, who had retired to Kenning-hall in Norfolk, in a very few days found herſelf at the head of 40,000 men; and Lady Jane reſigned the ſovereignty in ten days, with much more pleaſure than ſhe had received it. She retired with her mother to their own habitation; and Northumberland finding his affairs quite deſperate, attempted to quit the kingdom. But he was ſtopped by the band of penſioner guards, who informed him that he muſt ſtay to juſtify their conduct in taking arms againſt their lawful ſovereign. He therefore ſurrendered himſelf to Mary; and was ſoon after executed, together with Sir John Gates and Sir Thomas Palmer, two infamous tools of his power. Sentence was alſo pronounced againſt Lady Jane Grey and her huſband Lord Guildford; but without any intention of putting it in execution againſt them at preſent, as their youth and innocence pleaded ſo ſtrongly in their favour, neither of them having yet reached their 17th year.

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297 Lady Jane Gray placed on the throne, but is forced to reſign it.

Mary now entered London, and was peaceably ſettled on the throne without any effuſion of blood. The Engliſh, however, ſoon found reaſon to repent their attachment to her cauſe. Though ſhe had at firſt ſolemnly promiſed to defend the religion and laws of her predeceſſor, ſhe no ſooner ſaw herſelf firmly eſtabliſhed on the throne, than ſhe reſolved to reſtore the Popiſh religion, and give back their former power to the clergy. Gardiner, Bonnar, and the other biſhops who had been impriſoned or ſuffered loſs during the laſt reign, were taken from priſon, reinſtated in their ſees, and now triumphed in their turn. On pretence of diſcouraging controverſy, the queen by her prerogative ſilenced all preachers throughout England, except ſuch as ſhould obtain a particular licenſe, and this ſhe was reſolved to give only to thoſe of her own perſuaſion. The greater part of the foreign Proteſtants took the firſt opportunity of leaving the kingdom; and many of the arts and manufactures, which they had ſucceſsfully introduced, fled with them. Soon after, the queen called a parliament, which ſeemed willing to concur in all her meaſures. They at once repealed all the ſtatutes with regard to religion that had paſſed during the reign of Edward VI. and the national religion was again placed on the ſame footing in which it had been at the death of Henry VIII.

295 Mary declared queen.

To ſtrengthen the cauſe of the Catholics, and give the

England. the queen more power to eſtabliſh the religion to which ſhe was ſo much attached, a proper match was to be ſought for her; and it was ſuppoſed that three had already been propoſed as candidates for her favour. Her affection ſeemed to be engaged by the earl of Devonſhire: but as he was rather attached to the princeſs Elizabeth, he received the overtures which were made him from the queen with neglect. The next perſon mentioned as a proper match for her was Cardinal Pole, a man greatly reſpected for his virtues; but as he was now in the decline of life, Mary ſoon dropped all thoughts of that alliance. At laſt ſhe caſt her eye on Philip II. of Spain, ſon to the emperor Charles V. He was then in the 27th year of his age, and conſequently agreeable in that reſpect to Mary, who was in her 48th year; but when her intentions with regard to this match became known, the greateſt alarm took place throughout the whole nation. The commons preſented ſuch a ſtrong remonſtrance againſt a foreign alliance, that the queen thought proper to diſſolve the parliament in order to get quit of their importunity. To obviate, however, all clamour, the articles of marriage were drawn up as favourably as poſſible for the intereſts of England. It was agreed, that though Philip ſhould have the title of king, the adminiſtration ſhould be entirely in the queen; that no foreigner ſhould be capable of holding any office in the kingdom; nor ſhould any innovation be made in the laws, cuſtoms, and privileges of the people; that Philip ſhould not carry the queen abroad without her conſent, or any of her children without the conſent of the nobility. Sixty thouſand pounds a-year were to be ſettled upon her as a jointure; and the male iſſue of this marriage were to inherit Burgundy and the Low Countries as well as the crown of England: and in caſe of the death of Don Carlos, Philip's ſon by his former marriage, without any heir, the queen's iſſue ſhould inherit all the reſt of the Spaniſh dominions alſo.

299 Propoſals of marriage to queen Mary.

300 Alliance with Spain generally diſagreeable.

All theſe conceſſions, however, were not ſufficient to quiet the apprehenſions of the people: they were conſidered merely as words of courſe, which might be retracted at pleaſure; and the whole nation murmured loudly againſt a tranſaction ſo dangerous to its ancient liberty and independence. An inſurrection was raiſed by Sir Thomas Wyatt, a Roman Catholic, at the head of 4000 men, who ſet out from Kent to London, publiſhing a declaration againſt the Spaniſh match and the queen's evil counſellors. Having advanced as far as Southwark, he required that the queen ſhould put the tower of London into his hands; that ſhe ſhould deliver four counſellors as hoſtages; and, in order to enſure the liberty of the nation, ſhould marry an Engliſhman. But his force was at preſent by far too ſmall to ſupport ſuch magnificent pretenſions; and he unluckily waited ſo much time without attempting any thing of importance, that the popular ferment entirely ſubſided, his followers abandoned him gradually, and he was at laſt obliged to ſurrender himſelf to Sir Maurice Berkeley near Temple-bar. His followers were treated with great cruelty: no fewer than 400 of them ſuffered by the hand of the executioner; 400 more were conducted with ropes about their necks into the queen's preſence, and there received their pardon. Wyatt himſelf was condemned and executed.

301 Wyatt's inſurrection.

302 He is condemned and executed with many of his followers.

This rebellion had almoſt proved fatal to the Princeſs Elizabeth, who for ſome time paſt had been treated with great ſeverity by her ſiſter. Mary, who poſſeſſed a moſt malignant and cruel heart, had never forgot the quarrel between their mothers; and when a declaration was made after her own acceſſion, recogniſing Queen Catharine's marriage as legal, ſhe was thus furniſhed with a pretence for accounting Elizabeth illegitimate. She was likewiſe obnoxious on account of her religion, which Elizabeth at firſt had not prudence ſufficient to conceal; though afterwards ſhe learned full well to diſguiſe her ſentiments. But, above all, her ſtanding ſo high in the affection of the earl of Devonſhire, was a crime not to be forgiven; and Mary made her ſenſible of her diſpleaſure by numberleſs mortifications. She was ordered to take place at court after the ducheſs of Suffolk and the counteſs of Lenox; to avoid which, and other indignities, Elizabeth at laſt retired from court altogether into the country. After the ſuppreſſion of Wyatt's rebellion ſhe was committed to the tower, and underwent a ſtrict examination before the council; but as Wyatt had made a declaration on the ſcaffold that ſhe was in no manner of way concerned, the queen found herſelf under a neceſſity of releaſing her. To get rid of ſuch a troubleſome rival, however, ſhe was offered in marriage to the duke of Savoy; and on Elizabeth's declining the propoſal, ſhe was committed cloſe priſoner to Woodſtoke. The rebellion proved fatal, however, to many perſons of diſtinction, and gave the queen an opportunity of manifeſting that unbounded cruelty which reigned in her heart. The tower, and all the priſons in the kingdom, were filled with nobility and gentry, who became objects of royal vengeance, more on account of their credit and intereſt with the people than any concern they were ſuppoſed to have had with Wyatt. Sir Nicholas Throgmorton was tried in Guildhall; but as no ſatisfactory evidence appeared againſt him, the jury gave a verdict in his favour. The queen was ſo much enraged at this diſappointment, that ſhe recommitted him to the tower, ſummoned the jury before the council, and at laſt ſent them all to priſon, fining them afterwards ſome of 1000l. and others of 2000l. each. Sir John Throgmorton, brother to Sir Nicholas juſt mentioned, was condemned and executed upon evidence which had been already rejected as inſufficient. But of all thoſe who periſhed on this occaſion, none excited more univerſal compaſſion than the unfortunate Lady Jane Grey and her huſband Lord Guilford Dudley. They had already received ſentence of death, as has been mentioned; and two days after the execution of Wyatt, they received orders to prepare for eternity. Lady Jane, who had been in expectation of this blow, was no way intimidated, but received the news with the moſt heroic reſolution. The place intended at firſt for their execution was Tower-hill; but the council, dreading the effects of the people's compaſſion for their youth, beauty, and innocence, gave directions that they ſhould be beheaded within the verge of the tower. The duke of Suffolk was ſoon after tried, condemned, and executed; but would have met with more compaſſion, had not his ambition

303 Princeſs Elizabeth harſhly treated.

304 Execution of Lady Jane Grey and her huſband.

England. ambition been the cauſe of his daughter's unhappy fate juſt mentioned. Sir Thomas Grey alſo loſt his life on the ſame account; but the cruel ſpirit of Mary was ſtill unſatisfied; and finding herſelf univerſally odious, that ſhe might free herſelf from any apprehenſions for what was paſt, as well as tyrannize with the more freedom in time to come, ſhe diſabled the people from reſiſtance, by ordering general muſters, and cauſing the commiſſioners ſeize their arms and lay them up in forts and caſtles.

305 The people diſarmed.

Notwithſtanding this unpopularity, however, the rebellion of Wyatt had ſo ſtrengthened the hands of government, that a parliament was aſſembled in hopes of gratifying the queen's wiſhes in regard to her marriage with Philip of Spain. To facilitate this purpoſe alſo, the emperor of Germany ſent over to England 400,000 crowns to be diſtributed among the members of parliament in bribes and penſions; a practice of which there had hitherto been no example in England. The queen, notwithſtanding her bigotry, reſumed the title of *Supreme Head of the Church*, which ſhe had dropped three months before. Gardiner made a ſpeech, in which he propoſed, that they ſhould inveſt the queen with a legal power of diſpoſing of the crown, and appointing her ſucceſſor; but the parliament, however obſequious in other reſpects, did not chooſe to gratify their ſovereign in a meaſure by which the kingdom of England might become a province of the Spaniſh monarchy. They would not even declare it treaſon to imagine or attempt the death of the queen's huſband during her life-time, though they agreed to ratify the articles of marriage Finding therefore that the parliament even yet was not ſufficiently obſequious, it was thought moſt proper to diſſolve them. Soon after this the marriage with Philip was ſolemnized; but as the latter had eſpouſed his queen merely with a view to become king of England, he no ſooner found himſelf diſappointed in this than he ſhowed a total want of affection for her as a wife. He paſſed moſt of his time at a diſtance from her in the Low Countries; and ſeldom wrote to her except when he wanted money, with which Mary would at all times gladly have ſupplied him even had it been at the expence of her kingdom, if in her power.

306 Marriage with Philip ſolemnized.

307 Proteſtants perſecuted.

The enemies of the ſtate being ſuppoſed to be ſuppreſſed, thoſe of the Proteſtant religion were next perſecuted. The old ſanguinary laws which had been rejected by a former parliament were now revived. Orders were given, that the prieſts and biſhops who had married ſhould be ejected; that the maſs ſhould be reſtored, and the pope's authority eſtabliſhed; and that the church and its privileges, all but their goods and eſtates, ſhould be put on the ſame footing on which they were before the commencement of the reformation. But as the gentry and nobility had already divided the church-lands among them, it was though inconvenient, and indeed impoſſible, to make a reſtoration of theſe. The perſons who chiefly promoted theſe meaſures were Gardiner biſhop of Wincheſter, and Cardinal Pole, who was a kinſman of Henry VIII. but had been long in Italy, and was now returned from it. The latter was for tolerating the Proteſtants; but the former, perceiving that rigorous meaſures would be moſt agreeable to the king and queen, declared himſelf againſt it. He was too prudent, however, to appear in perſon at the head of the perſecution; and therefore conſigned that office to Bonnar biſhop of London, a man of a very abandoned character. The bloody ſcene began by the execution of Hooper biſhop of Glouceſter, and Rogers prebendary of St Paul's. Theſe were quickly followed by others, of whom the principal were Archbiſhop Cranmer, Ridley biſhop of London, and Latimer biſhop of Worceſter *. Theſe perſecutions ſoon became odious to the whole nation, and the perpetrators of them were all willing to throw the blame from themſelves upon others. Philip endeavoured to faſten the whole reproach upon Bonnar; but that biſhop would not take the whole, and therefore retorted on the court. A bold ſtep was now taken to introduce a court ſimilar to the Spaniſh inquiſition, that ſhould be empowered to try heretics, and condemn them without any other law but its own authority. But even this was thought a method too dilatory in the preſent exigence of affairs. A proclamation iſſued againſt books of hereſy, treaſon, and ſedition, declared, that whoſoever had ſuch books in his poſſeſſion, and did not burn them without reading, ſhould ſuffer as a rebel. This was attended with the execution of ſuch numbers, that at laſt the magiſtrates who had been inſtrumental in theſe cruelties refuſed to give their aſſiſtance any longer. It was computed, that during this perſecution, 277 perſons ſuffered by fire, beſides thoſe puniſhed by impriſonments, fines, and confiſcations. Among thoſe who ſuffered by fire were 5 biſhops, 21 clergymen, 8 lay gentlemen, 84 tradeſmen, 100 huſbandmen, 55 women, and 4 children.

England.

* See *Cranmer*, &c.

The only remarkable tranſaction which happened during this reign with regard to the temporal affairs of the kingdom was the loſs of Calais, which had been in the poſſeſſion of the Engliſh for upwards of 200 years †. This loſs filled the whole kingdom with complaints, and the queen with grief. She was heard to ſay, that, when dead, the name of *Calais* would be found engraven on her heart. She did not long ſurvive this loſs; but died in the year 1558, of a lingering illneſs, after a reign of five years four months and eleven days

† See *Calais*

308 Mary dies, and is ſucceeded by Elizabeth.

After the death of Mary, the princeſs Elizabeth ſucceeded to the throne without oppoſition. She was at Hatfield when news of her ſiſter's death were brought her; upon which ſhe haſtened up to London, where ſhe was received with great joy. This princeſs was well qualified for government. She had judgment ſufficient to make choice of proper miniſters, and authority enough to keep her ſubjects in awe. The reſtraints alſo, to which ſhe had been ſubjected during her ſiſter's reign, had taught her ſo well to conceal her ſentiments, that ſhe had become a perfect miſtreſs of diſſimulation; which, though no commendable part of her character, proved occaſionally of great ſervice to her government. She perfected the reformation, and put the religion of England upon the ſame plan which ſubſiſts at preſent. This was accompliſhed without the leaſt difficulty; for the perſecutions in Mary's reign had ſerved only to give the whole nation an averſion for popery. In the time of Edward VI. the people had been compelled to embrace the Proteſtant religion, and their fears induced them to conform; but now, almoſt the whole nation were Proteſtants from inclination. The reformation was confirmed by act of parliament in 1559, and thus

England. thus England was ſeen to change its religion four times in the ſpace of 32 years.

309 Peace with France. During the time that the queen and her counſellors were employed in ſettling the religious affairs of the nation, negotiations were likewiſe carried on for a peace between England and France; which was at laſt concluded on the following terms, viz. that Henry ſhould reſtore Calais at the expiration of eight years; that in caſe of failure, he ſhould pay 500,000 crowns, and Elizabeth's title to Calais ſtill remain; that for the payment of this ſum he ſhould find the ſecurity of eight foreign merchants, not natives of France; and until that ſecurity were provided he ſhould deliver five hoſtages. If during this interval Elizabeth ſhould break the peace with France or Scotland, ſhe ſhould forfeit all title to Calais; but if Henry made war on Elizabeth, he ſhould be obliged to reſtore the fortreſs immediately. This pacification was ſoon followed by an irreconcileable quarrel with Mary queen of Scotland; which was not extinguiſhed but by the death of the Scottiſh princeſs; and that with ſuch circumſtances of accumulated treachery, hypocriſy, and diſſimulation, as have ſtamped an indelible diſgrace on the memory of Elizabeth. See the articles MARY and SCOTLAND.

310 Preparations for war with Spain. Elizabeth having at laſt got rid of her rival in the year 1587, began to make preparations for reſiſting the Spaniſh invaſion. Hearing that Philip was ſecretly fitting out a great navy to attack her, ſhe ſent Sir Francis Drake with a fleet to pillage his coaſts and deſtroy his ſhipping. On this expedition he ſet ſail with four capital ſhips furniſhed by the queen, and 26 others of various ſizes furniſhed him by the merchants of London in hopes of ſharing the plunder.

311 Exploits of Sir Francis Drake. Having learned that a Spaniſh fleet richly laden was lying at Cadiz in readineſs to ſet ſail for Liſbon, he directed his courſe towards the former port, where he boldly attacked the enemy. Six galleys were obliged to take ſhelter under the cannon of the forts; he burned about 100 veſſels laden with ammunition and naval ſtores; and deſtroyed a great ſhip belonging to the marquis de Santa Croce. Thence ſetting ſail for Cape St Vincent, he took by aſſault the caſtle ſituated on that promontory, with three other fortreſſes. Having next inſulted Liſbon, he ſailed to the iſland Tercera, one of the Azores, where, after lying in wait for ſome time, he took a rich prize, and then returned to England; having by this ſhort expedition taught the Engliſh to deſpiſe the huge and unwieldy ſhips of the enemy, and thus prepared them to act with more reſolution againſt the formidable armament that now threatened to invade them.

312 Miſcarriage of Philip's ſcheme of an invaſion. But though the expedition of Sir Francis Drake had retarded the intended invaſion of England for a twelvemonth, it had not by any means induced Philip to abandon his deſign. During that interval he continued his preparations with the greateſt aſſiduity, the more eſpecially as the invaſion of England ſeemed to be a neceſſary preparative for regaining his authority over the Netherlands, the revolted provinces having been ſtrongly ſupported by Elizabeth. The fleet prepared at this time was ſuperior to any thing then exiſting in the world; and no doubt being entertained of its ſucceſs, it was oſtentatiouſly ſtyled the *Invincible Armada*. The miſerable event of this expedition, and the total failure of all the mighty hopes of Philip, are related under the article ARMADA. The ſpirit and courage of the Engliſh were now excited to attempt invaſions in their turn; which they executed in numerous deſcents on the Spaniſh coaſts; though theſe were only temporary, and deſigned not for permanent conqueſt, but to haraſs the enemy. It would be endleſs to relate all the advantages obtained over the enemy at ſea, where the capture of every ſhip muſt have been a ſeparate narrative. It is ſufficient to obſerve, that the ſea-captains of that reign are ſtill conſidered as the boldeſt and moſt enterpriſing ſet of men that England ever produced; and among this number we are to reckon Raleigh and Howard, Drake, Cavendiſh, and Hawkins. The Engliſh navy then began to take the lead; and has ſince continued irreſiſtible in all parts of the ocean. England.

Elizabeth continued to reign with great glory till the year 1603; but all her greatneſs could not prevent her from being extremely miſerable before her death. She had cauſed her greateſt favourite, and probably her lover, the earl of Eſſex †, to be executed. Though this execution could not be called unjuſt, the queen's affection (on being informed that he had at laſt thrown himſelf entirely on her clemency) returned to ſuch a degree, that ſhe thenceforth gave herſelf entirely over to deſpair. She refuſed food and ſuſtenance; ſhe continued ſilent and gloomy; ſighs and groans were the only vent ſhe gave to her deſpondence; and ſhe lay for ten days and nights upon the carpet, leaning on cuſhions, which her maids brought her. Perhaps the faculties of her mind were impaired by long and violent exerciſe; perhaps ſhe reflected with remorſe on ſome paſt actions of her life, or perceived, but too ſtrongly, the decays of nature, and the approach of her diſſolution. She ſaw her courtiers remitting in their aſſiduity to her, in order to pay their court to James the apparent ſucceſſor. Such a concurrence of cauſes was more than ſufficient to deſtroy the remains of her conſtitution; and her end was now viſibly ſeen to approach. Feeling a perpetual heat in her ſtomach, attended with an unquenchable thirſt, ſhe drank without ceaſing, but refuſed the aſſiſtance of her phyſicians. Her diſtemper gaining ground, Cecil and the lord admiral deſired to know her ſentiments with regard to the ſucceſſion. To this ſhe replied, that as the crown of England had always been held by kings, it ought not to devolve upon any inferior character, but upon her immediate heir the king of Scotland. Being then adviſed by the archbiſhop of Canterbury to fix her thoughts upon God, ſhe replied, that her thoughts did not in the leaſt wander from him. Her voice ſoon after left her; ſhe fell into a lethargic ſlumber, which continued ſome hours; and ſhe expired gently without a groan, in the 70th year of her age, and 45th of her reign. She was ſucceeded by James I. king of Scotland; ſince which time, the hiſtory of both England and Scotland is comprehended under the article BRITAIN.

† See *Devereux*.

313 Grief and miſery of Elizabeth.

314 Her death.

315 England, how divided. Since the Norman conqueſt, England has been divided into ſix circuits, each circuit containing a certain number of counties. Two judges are appointed for each circuit, which they viſit in the ſpring and autumn, for adminiſtering juſtice to the ſubjects who are at a diſtance from the capital. In holding the lent (or ſpring) aſſizes, the northern circuit extends only to York and Lancaſter; the aſſizes at Durham, Newcaſtle, Carliſle, and Appleby, being held only in the autumn,

England. autumn, and diſtinguiſhed by the appellation of the *long circuit*. Theſe circuits and counties are:

1. *Home Circuit* contains the counties of Eſſex, Hertford, Kent, Surry, and Suſſex.

2. *Norfolk Circuit* contains thoſe of Bucks, Bedford, Huntingdon, Cambridge, Suffolk, and Norfolk.

3. *Oxford Circuit*. Oxon, Berks, Glouceſter, Worceſter, Monmouth, Hereford, Salop, and Stafford.

4. *Midland Circuit*. Warwick, Leiceſter, Derby, Nottingham, Lincoln, Rutland, and Northampton.

5. *Weſtern Circuit*. Hants, Wilts, Dorſet, Somerſet, Devon, and Cornwall.

6. *Northern Circuit*. York, Durham, Northumberland, Lancaſter, Weſtmorland, and Cumberland.

Middleſex and Cheſhire are not comprehended in the above circuits; the former being the ſeat of the ſupreme courts of juſtice, and the latter a county palatine. There is ſtill a court of chancery in Lancaſter and Durham, with a chancellor; and there is a court of exchequer at Cheſter, of a mixed kind, both for law and equity, of which the chamberlain of Cheſter is judge: there are alſo other juſtices in the counties palatine, to determine civil actions and pleas of the crown.

Beſides the 40 counties into which England is divided, there are counties corporate, conſiſting of certain diſtricts, to which the liberties and juriſdictions peculiar to a county have been granted by charter from the throne. Thus the city of London is a county diſtinct from Middleſex; the cities of York, Cheſter, Briſtol, Norwich, Worceſter, and the towns of Kingſton upon Hull and Newcaſtle upon Tyne, are counties of themſelves, diſtinct from thoſe in which they lie. The ſame may be ſaid of Berwick upon Tweed, which lies in Scotland, and has within its juriſdiction a ſmall territory of two miles on the north ſide of the river. Under the name of a *town*, boroughs and cities are contained: for every borough or city is a town, though every town is not a borough or city.—An account of the Engliſh conſtitution and government is given under the articles KING, LORDS, COMMONS, PARLIAMENT, LAW, LIBERTY, RIGHTS, &c.

516 Religion. The eſtabliſhed religion of England is Epiſcopacy. Since the reign of Henry VIII. the ſovereigns of England have been called, in public writs, the ſupreme heads of the church; but this title conveys no ſpiritual meaning, as it only denotes the regal power to prevent any eccleſiaſtical differences, or, in other words, to ſubſtitute the king in place of the pope before the reformation, with regard to temporalities and the internal economy of the church. The kings of England never intermeddle in eccleſiaſtical diſputes, and are contented to give a ſanction to the legal rights of the clergy.

The church of England, under this deſcription of the monarchical power over it, is governed by two archbiſhops, and 24 biſhops, beſides the biſhop of Sodor and Man, who, not being poſſeſſed of an Engliſh barony, does not ſit in the houſe of peers. See ARCHBISHOP and BISHOP.

England contains about 60 archdeacons. Subordinate to them are the rural deacons, formerly ſtyled *archpreſbyters*, who ſignify the biſhop's pleaſure to his clergy, the lower claſs of which conſiſts of pariſh-prieſts (who are called *rectors* or *vicars*), deacons and curates. See the articles CURATE, DEACON, PARSON, England. and VICAR.

The following is a liſt of the Engliſh biſhoprics, with their revenues, as charged in the king's books; though that ſum is far from being the real annual value of the ſee, yet it aſſiſts in forming a comparative eſtimate between the revenues of each ſee with thoſe of another. 517 Revenues of the clergy.

	L.	s.	d.
ARCHBISHOPRICS.			
Canterbury,	2682	12	2
York,	1610	0	0
BISHOPRICS.			
London,	2000	0	0
Durham,	1821	1	3
Wincheſter,	3124	12	8

Theſe three biſhops take precedency of all others in England, and the others according to the ſeniority of their conſecrations.

Ely,	2134	18	6
Bath and Wells,	533	1	3
Hereford,	768	11	0
Rocheſter,	358	4	9
Litchfield and Coventry,	559	17	3
Cheſter,	420	1	8
Worceſter,	929	13	3
Chicheſter,	677	1	3
St Aſaph,	187	11	8
Saliſbury,	1385	5	0
Bangor,	131	16	3
Norwich,	834	11	7
Glouceſter,	315	7	3
Llandaff,	154	14	2
Lincoln,	894	18	1
Briſtol,	297	11	0
Carliſle,	531	4	9
Exeter,	500	0	0
Peterborough,	414	14	8
Oxford,	381	11	0
St Davids,	426	2	1

The eccleſiaſtical government of England is, properly ſpeaking, lodged in the convocation; which is a national repreſentative or ſynod, and anſwers pretty near to the ideas we have of a parliament. They are convoked at the ſame time with every parliament; and their buſineſs is to conſider of the ſtate of the church, and to call thoſe to an account who have advanced new opinions, inconſiſtent with the doctrines of the church of England. Some high-flying clergymen during the reign of Queen Anne, and in the beginning of that of George I. raiſed the powers of the convocation to a height that was inconſiſtent with the principles of religious toleration, and indeed of civil liberty: ſo that the crown was obliged to exert its prerogative of calling the members together, and of diſſolving them; and ever ſince they have not been permitted to ſit for any time, in which they could do buſineſs.

The following table exhibits a view of the population of England, taken from the returns made to the houſe of commons in conſequence of an act of parliament which was paſſed for the purpoſe of aſcertaining the number of inhabitants in the kingdom. From this table it appears that the total number of perſons in England amounts to 8,331,434.

COUNTIES.

ENGLAND.
SCOTLAND
IRELAND
BRITISH
OCEAN
IRISH
SEA
ENGLISH
CHANNEL
FRANCE
St GEORGES CHANNEL
BRISTOL CHANNEL
UNITED PROVINCES
FLANDERS
Edinburgh
Berwick
Holy I.
Staples
Alnwick
Coquet R.
Coquet I.
Morpeth
NORTHUMBERLAND
Tinmouth C.
Shields
Sunderland
Carlisle
CUMBERLAND
Penrith
Durham
DURHAM
Stockton
Cockermouth
Whitehaven
WESTMORELAND
Appleby
Ravenglass
Kendal
Burton
Bolanwood
Allerton
Whitby
Scarborough
Thirsk
Bekering
Ripon
Boroughbridge
New Malton
York
Wetherby
Tadcaster
Hull
Bridlington
Preston
LANCASHIRE
Wigan
Halifax
Leeds
Wakefield
Barnsley
Doncaster
Gainsborough
Lincoln
Spurn Hd
Wainfleet
Boston
LINCOLNSHIRE
Wells
Cromer
Walsingham
Lynne
Norwich
Yarmouth
Easton Ness
Southwold
NORFOLK
Liverpool
Manchester
Warrington
Chester
CHESHIRE
Derby
Nottingham
Newark
Grantham
Stamford
Peterboro
Ely
Bedford
Cambridge
Ipswich
SUFFOLK
Orford
Harwich
Colchester
Chelmsford
Malden
ESSEN
Dublin
Howth
Drogheda
Dundalk
Carlingford
Gulf of Man
Peel C.
Ramsey
Lof Man
Castleton
Douglas
Strangford
Down
Belfast
Donaghadee
Mull of Galloway
Port Patrick
Glenluce
Wigton
Dumfries
Air
Ailsa
Arran I.
Ilay
Fair Head
Coleraine
Londonderry
Angleshey I.
Holy Head
Beaumaris
Carnarvon
Badger
Denbigh
Ruthin
Wrexham
Oswestry
Shrewsbury
Litchfield
Stafford
Uttoxeter
Derby
Leicester
Rutland
Hampton
Northampton
Bedford
Buckingham
Aylesbury
Hertford
Ware
Chelmsford
Malden
Harwich
Colchester
Ongar
Braintree
Dunmow
Saffron Walden
Newmarket
Bury
Thetford
Swaffham
Lynne
Wells
Cromer
Walsingham
Norwich
Yarmouth
Easton Ness
Southwold
Orford
Ipswich
Harwich
Colchester
Chelmsford
Malden
Middelburg
Arnemuyden
Veere
Flushing
Helvoetsluys
Goree
Brill
Rotterdam
Dort
Gorcum
Schiedam
Delft
Leyden
Haerlem
Amsterdam
Enkhuysen
Medemblick
Horn
Texel
Vlie
Ameland
Schelling
Terschelling
Vlieland
Wadden
Ems R.
Dollart
Groningen
Lauwerzee
Friesland
Leeuwarden
Sneek
Staveren
Kampen
Zwolle
Deventer
Zutphen
Arnheim
Nimeguen
Utrecht
Amersfort
Gelderland
Overyssel
Utrecht
Rhine R.
Wahal R.
Meuse R.
Yssel R.
Zuyder Zee
Ostend
Dunkirk
Calais
Boulogne
Romney
Hythe
Dover
Deal
N. Foreland
Canterbury
Ashford
Rye
Winchelsea
Hastings
Pevensey
Bexhill
Battle
Brighthelmstone
Lewes
Chichester
Arundel
Shoreham
Bramber
Horsham
Guildford
Farnham
Godalming
Reigate
Dorking
Kingston
Richmond
Hampton Court
Staines
Windsor
Egham
Chertsey
Weybridge
Esher
Epsom
Croydon
Bromley
Greenwich
Deptford
Blackheath
Woolwich
Dartford
Gravesend
Rochester
Chatham
Sheerness
Queenborough
Faversham
Sittingbourne
Milton
Whitstable
Margate
Ramsgate
Sandwich
Deal
Walmer
Dover
Folkestone
Hythe
Romney

England, New England.

COUNTIES.	HOUSES.		PERSONS.		OCCUPATIONS.		Total of Perſons.
	Inhabited.	By how many Families occupied.	Males.	Females.	Perſons chiefly employed in Agriculture.	Ditto in Trade Manufactures, or Handicraft	
Bedford	11,888	13,980	30,523	32,870	18,766	13,816	63,393
Berks	20,573	23,416	52,821	56,394	38,155	16,921	109,215
Buckingham	20,443	23,384	52,094	55,354	25,083	20,138	107,444
Cambridge	16,139	19,262	44,031	45,265	23,054	11,988	89,346
Cheſter	34,482	37,613	92,759	98,992	38,823	67,447	191,751
Cornwall	32,906	39,040	89,868	98,401	42,687	24,870	188,269
Cumberland	21,573	25,893	54,377	62,853	21,062	18,387	117,230
Derby	31,822	33,660	79,401	81,471	31,743	39,516	161,142
Devon	57,955	72,559	157,240	185,761	96,208	60,844	343,001
Dorſet	21,437	24,142	53,667	61,652	28,204	22,259	115,319
Durham	27,195	38,109	74,770	85,591	18,217	25,208	160,361
Eſſex	38,371	46,784	111,356	115,081	65,174	25,283	226,437
Glouceſter	46,457	55,133	117,180	133,629	49,420	49,645	250,809
Hereford	17,003	18,822	43,955	45,236	31,261	8,588	89,191
Hertford	17,681	20,092	48,063	49,514	20,611	12,861	97,577
Huntingdon	6,841	8,150	18,521	19,047	9,536	4,484	37,568
Kent	51,585	65,967	151,374	156,250	54,124	43,253	307,624
Lancaſter	114,270	132,147	322,356	350,375	52,018	269,259	672,731
Leiceſter	25,992	27,967	63,943	66,138	23,823	42,036	130,081
Lincoln	41,395	42,629	102,445	106,112	60,584	24,263	208,557
Middleſex	112,912	199,854	373,655	444,474	43,417	162,260	818,129
Monmouth	8,948	9,903	22,173	23,409	12,871	5,540	45,582
Norfolk	47,617	57,930	129,842	143,529	61,791	38,181	273,371
Northampton	26,665	29,361	63,417	68,340	29,303	31,426	131,757
Northumberland	26,518	35,503	73,357	83,744	23,190	25,738	157,101
Nottingham	25,611	30,081	68,558	71,792	23,904	35,513	140,350
Oxford	20,599	23,750	53,786	55,834	33,109	16,346	109,620
Rutland	3,274	3,563	7,978	8,378	3,995	1,923	16,356
Salop	31,182	34,501	82,563	85,076	45,046	35,535	167,639
Somerſet	48,040	57,013	126,927	146,823	61,434	54,053	273,750
Southampton	38,345	45,331	105,667	113,989	50,696	30,303	219,656
Stafford	45,198	48,185	118,698	120,455	43,930	72,465	239,153
Suffolk	32,253	43,481	101,091	109,340	55,744	34,064	210,431
Surrey	46,072	63,673	127,138	141,905	2,746	42,865	269,043
Suſſex	25,272	30,755	78,797	80,514	38,925	19,608	159,311
Warwick	40,847	44,028	99,942	108,248	34,756	91,922	208,190
Weſtmorland	7,897	9,026	20,175	21,442	12,141	8,673	41,617
Wilts	29,462	30,527	87,380	97,727	53,517	39,422	185,107
Worceſter	26,711	29,741	67,631	71,702	38,865	30,230	139,333
York (East Riding)	25,781	31,544	67,457	71,976	31,538	22,003	139 433
(North Riding)	31,512	34,542	74,904	80,602	44,061	26,207	155,506
(Weſt Riding)	111,146	117,379	276,005	287,948	55,695	164,188	563,953
	1,467,870	1,778,420	3,987,935	4,243,499	1,524,227	1,789,531	8,331,434

NEW ENGLAND, late a province of the Britiſh empire in America, is bounded on the north by Canada, on the eaſt by Nova Scotia and the Atlantic ocean, on the ſouth by the Atlantic and Long Iſland ſound, and on the weſt by New York. It lies in the form of a quarter of a circle. Its weſt line, beginning at the mouth of Byram river, which empties into Long Iſland ſound at the ſouth-weſt corner of Connecticut, latitude 41°, runs a little eaſt of north, until it ſtrikes the 45th degree of latitude, and then curves to the eaſtward almoſt to the gulf of St Lawrence.

1 When firſt diſcovered.

This country was diſcovered in the beginning of the laſt century, and called *North Virginia*; but no Europeans ſettled there till the year 1608. The firſt colony, which was weak and ill-directed, did not ſucceed; and, for ſome time, there were only a few adventurers who came over at times in the ſummer, built themſelves temporary huts for the ſake of trading with the ſavages, and, like them, diſappeared again for the

New England.

reſt of the year. At laſt ſome Browniſts, headed by Mr Robinſon, whom Neal ſtyles the Father of the Independents, who in 1610 had been driven from England by perſecution, fled to Holland, and ſettled at Leyden; but in 1621 determined, with Mr Brewſter aſſiſtant-preacher to Mr Robinſon, to found a church for their ſect in the new hemiſphere. They therefore purchaſed, in 1521, the charter of the Engliſh North Virginia-company. Forty-one families, making in all 120 perſons, landed in the beginning of a very hard winter, and found a country entirely covered with wood, which offered a very melancholy proſpect to men already exhauſted with the fatigues of their voyage. Near one half periſhed either by cold, the ſcurvy, or other diſtreſs. The courage of the reſt was beginning to fail; when it was revived by the arrival of 60 ſavage warriors, who came to them in the ſpring, headed by their chief. The old tenants aſſigned for ever to the new ones all the lands in the neighbourhood of the ſettlement they had formed, under the name of *New Plymouth*; and one of the ſavages who underſtood a little Engliſh ſtaid to teach them how to cultivate the maize, and inſtruct them in the manner of fiſhing upon their coaſt.

This kindneſs enabled the colony to wait for the companions they expected from Europe with ſeeds, with domeſtic animals, and with every aſſiſtance they wanted. At firſt theſe ſuccours arrived but ſlowly; but the perſecution of the Puritans in England increaſed the number of proſelytes to ſuch a degree in America, that in 1630 they were obliged to form different ſettlements, of which Boſton ſoon became the principal. Theſe firſt ſettlers were not merely eccleſiaſtics, who had been deprived of their preferments on account of their opinions; nor thoſe ſectaries influenced by new opinions, that are ſo frequent among the common people. There were among them ſeveral perſons of high rank, who, having embraced Puritaniſm, had taken the precaution to ſecure themſelves an aſylum in theſe diſtant regions. They had cauſed houſes to be built, and lands to be cleared, with a view of retiring there, if there endeavours in the cauſe of civil and religious liberty ſhould prove abortive.

Raynal's Hiſtory of European Settlements.

The inhabitants of New England lived peaceably for a long time, without any regular form of policy. Their charter had indeed authorized them to eſtabliſh any mode of government they might chooſe; but theſe enthuſiaſts were not agreed among themſelves upon the plan of their republic, and government did not pay ſufficient attention to them to urge them to ſecure their own tranquillity. At length they grew ſenſible of the neceſſity of a regular legiſlation; and this great work, which virtue and genius united have never attempted but with diffidence, was boldly undertaken by blind fanaticiſm. It bore the ſtamp of the rude prejudices

2 First code of laws.

on which it had been formed. There was in this new code a ſingular mixture of good and evil, of wiſdom and folly. No man was allowed to have a ſhare in the government except he were a member of the eſtabliſhed church. Witchcraft, perjury, blaſphemy, and adultery, were made capital offences; and children were alſo puniſhed with death, either for curſing or ſtriking their parents. Marriages, however, were to be ſolemnized by the magiſtrate. The price of corn was fixed at 2s. 11½d. per buſhel. The ſavages who neglected to cultivate their lands were to be deprived of them; and Europeans were forbidden under a heavy penalty to ſell them any ſtrong liquors or warlike ſtores. All thoſe who were detected either in lying, drunkenneſs, or dancing, were ordered to be publicly whipped. But at the ſame time that amuſements were forbidden equally with vices and crimes, one might be allowed to ſwear by paying a penalty of 11¼d. and to break the ſabbath for 2l. 19s. 9½d. Another indulgence allowed was, to atone, by a fine, for a neglect of prayer, or for uttering a raſh oath. But it is ſtill more extraordinary, that the worſhip of images was forbidden to the Puritans on pain of death; which was alſo inflicted on Roman Catholic prieſts, who ſhould return to the colony after they had been baniſhed; and on Quakers who ſhould appear again after having been whipped, branded, and expelled. Such was the abhorrence for theſe ſectaries, who had themſelves an averſion for every kind of cruelty, that whoever either brought one of them into the country, or harboured him but for one hour, was liable to pay a conſiderable fine.

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3 Quakers perſecuted.

Thoſe unfortunate members of the colony, who, leſs violent than their brethren, ventured to deny the coercive power of the magiſtrate in matters of religion, were perſecuted with ſtill greater rigour. This was conſidered as blaſphemy by thoſe very divines who had rather choſen to quit their country than to ſhow any deference to Epiſcopal authority. This ſyſtem was ſupported by the ſeverities of the law, which attempted to put a ſtop to every difference in opinion, by inflicting capital puniſhment on all who diſſented. Thoſe who were either convicted, or even ſuſpected, of entertaining ſentiments of toleration, were expoſed to ſuch cruel oppreſſions, that they were forced to fly from their firſt aſylum, and ſeek refuge in another. They found one on the ſame continent; and as New England had been firſt founded by perſecution, its limits were extended by it.

This intemperate religious zeal extended itſelf to matters in themſelves of the greateſt indifference. A proof of this is found in the following public declaration, tranſcribed from the regiſters of the colony.

4 Law againſt wearing long hair.

"It is a circumſtance univerſally acknowledged, "that the cuſtom of wearing long hair, after the "manner of immoral perſons and of the ſavage In- "dians, can have been introduced into England only "in ſacrilegious contempt of the expreſs command of "God, who declares that it is a ſhameful practice for "any man who has the leaſt care for his ſoul to wear "long hair. As this abomination excites the indig- "nation of all pious perſons; we, the magiſtrates, in "our zeal for the purity of the faith, do expreſsly "and authentically declare, that we condemn the im- "pious cuſtom of letting the hair grow; a cuſtom "which we look upon to be very indecent and diſho- "neſt, which horribly diſguiſes men, and is offenſive "to modeſt and ſober perſons, in as much as it cor- "rupts good manners. We therefore, being juſtly "incenſed againſt this ſcandalous cuſtom, do deſire, "adviſe, and earneſtly requeſt all the elders of our "continent, zealouſly to ſhow their averſion for this "odious practice, to exert all their power to put a "ſtop to it, and eſpecially to take care that the mem- "bers of their churches be not infected with it; in

"order

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" order that thoſe perſons who, notwithſtanding theſe " rigorous prohibitions, and the means of correction " that ſhall be uſed on this account, ſhall ſtill perſiſt in " this cuſtom, ſhall have both God and man at the ſame " time againſt them."

This ſeverity ſoon exerted itſelf againſt the Quakers. They were whipped, baniſhed, and impriſoned. The behaviour of theſe new enthuſiaſts, who in the midſt of tortures and ignominy praiſed God, and called for bleſſings upon men, inſpired a reverence for their perſons and opinions, and gained them a number of proſelytes. This circumſtance exaſperated their perſecutors, and hurried them on to the moſt atrocious acts of violence; and they cauſed five of them, who had returned clandeſtinely from baniſhment, to be hanged. This ſpirit of perſecution was, however, at laſt ſuppreſſed by the interpoſition of the mother-country, from whence it had been brought. Charles II. moved with the ſufferings of the Quakers, put a ſtop to them by a proclamation in 1661; but he was never able totally to extinguiſh the ſpirit of perſecution that prevailed in America.

The colony had placed at their head Henry Vane, the ſon of that Sir Henry Vane who had ſuch a remarkable ſhare in the diſturbances of his country. This obſtinate and enthuſiaſtic young man had contrived to revive the queſtions of grace and free will. The diſputes upon theſe points ran very high; and would probably have plunged the colony into a civil war, if ſeveral of the ſavage nations united had not happened at that very time to fall upon the plantations of the diſputants, and to maſſacre great numbers of them. The coloniſts, heated with their theological conteſts, paid at firſt very little attention to this conſiderable loſs. But the danger at length became ſo urgent and ſo general, that all took up arms. As ſoon as the enemy was repulſed, the colony reſumed its former diſſenſions; and the frenzy which they excited broke out in 1692 in a war, marked with as many atrocious inſtances of violence as any ever recorded in hiſtory.

5 Extraordinary perſecution of witches.

There lived in a town of New England, called *Salem*, two young women who were ſubject to convulſions, accompanied with extraordinary ſymptoms. Their father, miniſter of the church, thought that they were bewitched; and having in conſequence caſt his ſuſpicions upon an Indian girl who lived in his houſe, he compelled her by harſh treatment to confeſs that ſhe was a witch. Other women, upon hearing this, immediately believed, that the convulſions, which proceeded only from the nature of their ſex, were owing to the ſame cauſe. Three citizens, caſually named, were immediately thrown into priſon, accuſed of witchcraft, hanged, and their bodies left expoſed to wild beaſts and birds of prey. A few days after, 16 other perſons, together with a counſellor, who, becauſe he refuſed to plead againſt them, was ſuppoſed to ſhare in their guilt, ſuffered in the ſame manner. From this inſtant, the imagination of the multitude was inflamed with theſe horrid and gloomy ſcenes. Children of ten years of age were put to death; young girls were ſtripped naked, and the marks of witchcraft ſearched for upon their bodies with the moſt indecent curioſity; and thoſe ſpots of the ſcurvy which age impreſſes upon the bodies of old men were taken for evident ſigns of the infernal power. In default of theſe, torments were employed to extort confeſſions dictated by the executioners themſelves. If the magiſtrates, tired out with executions, refuſed to puniſh, they were themſelves accuſed of the crimes they tolerated; the very miniſters of religion raiſed falſe witneſſes againſt them, who made them forfeit with their lives the tardy remorſe excited in them by humanity. Dreams, apparitions, terror, and conſternation of every kind, increaſed theſe prodigies of folly and horror. The priſons were filled, the gibbets left ſtanding, and all the citizens involved in gloomy apprehenſions. The moſt prudent quitted the country ſtained with the blood of its inhabitants; and nothing leſs than the total and immediate ſubverſion of the colony was expected, when, on a ſudden, all eyes were opened at once, and the exceſs of the evil awakened the minds which it had firſt ſtupified. Bitter and painful remorſe was the immediate conſequence; the mercy of God was implored by a general faſt, and public prayers were offered up to aſk forgiveneſs for the preſumption of having ſuppoſed that Heaven could have been pleaſed with ſacrifices with which it could only have been offended.

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Poſterity will probably never know exactly what was the cauſe or remedy of this dreadful diſorder. It had, perhaps, its firſt origin in the melancholy which thoſe perſecuted enthuſiaſts had brought with them from their own country, which had increaſed with the ſcurvy they had contracted at ſea, and had gathered freſh ſtrength from the inconveniences and hardſhips inſeparable from a change of climate and manner of living. The contagion, however, ceaſed like all other epidemical diſtempers, exhauſted by its very communication. A perfect calm ſucceeded this agitation; and the Puritans of New England have never ſince been ſeized with ſo gloomy a fit of enthuſiaſm.

But though the colony has renounced the perſecuting ſpirit which hath ſtained all religious ſects with blood, it has preſerved ſome remains, if not of intoleration, at leaſt of ſeverity, which remind us of thoſe melancholy days in which it took its riſe. Some of its laws are ſtill too ſevere.

New England had, however, ſome remedy againſt bad laws, in the conſtitution of its mother-country, where the people who have the legiſlative power in their own hands are at liberty to correct abuſes; and it has others derived from its ſituation, which open a vaſt field to induſtry and population.

6 Manner of ſettlement in this colony.

The clearing of the lands in this colony is not directed by chance as in the other provinces. This matter from the firſt was ſubjected to laws which are ſtill religiouſly obſerved. No citizen whatever has the liberty of ſettling even upon unoccupied land. The government, deſirous of preſerving all its members from the inroads of the ſavages, and of placing them in a condition to ſhare in the protection of a well-regulated ſociety, hath ordered that whole villages ſhould be formed at once. As ſoon as 60 families offer to build a church, maintain a clergyman, and pay a ſchool maſter, the general aſſembly allot them a ſituation, and permit them to have two repreſentatives in the legiſlative body of the colony. The diſtrict aſſigned them always borders upon the lands already cleared, and generally contains 60,000 ſquare acres. Theſe new people chooſe the ſituation moſt convenient for their habitation,

New England.

tion, which is usually of a square figure. The church is placed in the centre; the colonists divide the land among themselves, and each incloses his property with a hedge. Some woods are reserved for a common; and thus New England is constantly enlarging its territory, though it still continues to make one complete and well constituted province.

7 Division, &c.

The country was divided into four states, which at first had no connexion with one another. The necessity of maintaining an armed force against the savages, obliged them to form a confederacy in 1643, when they took the name of the *United Colonies*. In consequence of this league, two deputies from each establishment used to meet in a stated place to deliberate upon the common affairs of New England, according to the instructions they had received from the assembly by which they were sent. This association laid no constraint upon the right of every individual to act entirely as he pleased, without either the permission or approbation of the mother-country. All the submission required of these provinces was merely to acknowledge the kings of England for their sovereigns. Charles II. wished to make them more dependent. The province of Massachuset's bay, which, though the smallest, was the richest and the most populous of the four, being guilty of some misdemeanour against government, the king seized that opportunity of taking away its charter in 1684: and it remained without one till the revolution; when it received another, which, however, did not answer its claims or expectations. The crown reserved to itself the right of nominating the governor, and appointing to all military employments, and to all principal posts in the civil and juridical departments: it allowed the people of the colony their legislative power, and gave the governor a negative voice and the command of the troops, which secured him a sufficient influence to enable him to maintain the prerogative of the mother-country in all its force. The provinces of Connecticut and Rhode-Island, by timely submission, prevented the punishment which that of Massachusets had incurred, and retained their original charter. That of New-Hampshire had been always regulated by the same mode of administration as the province of Massachusets bay. The same governor presided over the whole colony, but with regulations adapted to the constitution of each province. To the above states, another has been added since the revolution, viz. VERMONT. These states are subdivided into counties, and the counties into townships.

8 Face of the country, mountains, &c.

New England is a high, hilly, and in some parts a mountainous country, formed by nature to be inhabited by a hardy race of free, independent republicans. —The mountains are comparatively small, running nearly north and south in ridges parallel to each other. Between these ridges flow the great rivers in majestic meanders, receiving the innumerable rivulets and larger streams which proceed from the mountains on each side. To a spectator on the top of a neighbouring mountain, the vales between the ridges, while in a state of nature, exhibit a romantic appearance. They seem an ocean of woods, swelled and depressed in its surface like that of the great ocean itself. A richer though less romantic view is presented, when the valleys, by industrious husbandmen, have been cleared of their natural growth; and the fruit of their labour appears in loaded orchards, extensive meadows, covered with large herds of sheep and neat cattle, and rich fields of flax, corn, and the various kinds of grain. These valleys, which have received the expressive name of *interval lands*, are of various breadths, from two to 20 miles; and by the annual inundations of the rivers which flow through them, there is frequently an accumulation of rich, fat soil, left upon their surface when the waters retire.

New England.

There are four principal ranges of mountains, passing nearly from north-east to south-west through New England. These consist of a multitude of parallel ridges, each having many spurs, deviating from the course of the general range; which spurs are again broken into irregular hilly land. The main ridges terminate, sometimes in high bluff heads, near the sea-coast, and sometimes by a gradual descent in the interior part of the country. One of the main ranges runs between Connecticut and Hudson's rivers. This range branches and bounds the vales through which flows the Housatonick river. The most eastern ridge of this range terminates in a bluff head at Meriden; a second ends in like manner at Willingford, and a third at New Haven. In Lyme, on the east side of Connecticut river, another range of mountains commences, forming the eastern boundary of Connecticut vale. This range tends northerly, at the distance, generally, of about 10 or 12 miles east from the river, and passes through Massachusets, where the range takes the name of *Chickabee Mountain*; thence crossing into New Hampshire, at the distance of about 20 miles from the Massachusets line, it runs up into a very high peak, called *Monadnick*, which terminates this ridge of the range. A western ridge continues, and in about latitude 43° 20′ runs up into Sunipee mountains. About 50 miles further, in the same ridge, is Mooscoog mountain. A third range begins near Stonington in Connecticut. It takes its course north-easterly, and is sometimes broken and discontinued; it then rises again, and ranges in the same direction into New Hampshire, where, in latitude 43° 25′, it runs up into a high peak called *Cowsawaskog*. The fourth range has a humble beginning about Hopkinton in Massachusets. The eastern ridge of this range runs north by Watertown and Concord, and crosses Merrimack river at Pantucket Falls. In New Hampshire, it rises into several high peaks, of which the White mountains are the principal. From these White mountains a range continues north-east, crossing the east boundary of New Hampshire, in latitude 44° 30′, and forms the height of land between Kennebek and Chaudiere rivers. These ranges of mountains are full of lakes, ponds, and springs of water, that give rise to numberless streams of various sizes, which, interlocking each other in every direction, and falling over the rocks in romantic cascades, flow meandering into the rivers below. No country on the globe is better watered than New England.

On the sea-coast the land is low, and in many parts level and sandy. In the valleys, between the forementioned ranges of mountains, the land is generally broken, and in many places rocky, but of a strong rich soil, capable of being cultivated to good advantage, which also is the case with many spots even on the tops of the mountains.

The

New England.

The principal river in New England is Connecticut. See CONNECTICUT.

9 Soil, productions, &c.

The ſoil, as may be collected from what has been ſaid, muſt be very various. Each tract of different ſoil is diſtinguiſhed by its peculiar vegetation, and is pronounced good, middling, or bad, from the ſpecies of trees which it produces; and from one ſpecies generally predominating in each ſoil, has originated the deſcriptive names of oak land, birch, beech, and cheſnut lands, pine, barren, maple, aſh, and cedar ſwamps, as each ſpecies happens to predominate. Intermingled with thoſe predominating ſpecies are walnut, firs, elm, hemlock, magnolia, mooſe-wood, ſaſſafras, &c. &c. The beſt lands produce walnut and cheſnut; the next, beech and oak; lands of the third quality produce fir and pitch-pine; the next, whortleberry and barberry buſhes; and the pooreſt produce nothing but marſhy imperfect ſhrubs. Among the flowering trees and ſhrubs in the foreſts are the red-flowering maple, the ſaſſafras, the locuſt-tree, the tulip-tree, honeyſuckle, wild roſe, dogwood, elm, leather-tree, laurel, hawthorn, &c. which in the ſpring of the year give the woods a moſt beautiful appearance, and fill them with a delicious fragrance. Among the fruits which grow wild, are the ſeveral kinds of grapes; which are ſmall, ſour, and thick ſkinned. The vines on which they grow are very luxuriant, often overſpreading the higheſt trees in the foreſts; and without doubt, may be greatly meliorated by proper cultivation. Beſides theſe, are the wild cherries, white and red mulberries, cranberries, walnuts, hazel nuts, cheſnuts, butter nuts, beech nuts, wild plums and pears, whortle-berries, bilberries, gooſeberries, ſtrawberries, &c.

The ſoil in the interior country is calculated for the culture of Indian corn, rye, oats, barley, flax, and hemp (for which the ſoil and climate are peculiarly proper), buck-wheat, beans, peaſe, &c. In many of the inland parts wheat is raiſed in large quantities; but on the ſea-coaſt it has never been cultivated with ſucceſs, being ſubject to blaſts. The fruits which the country yields from culture, are apples in the greateſt plenty; of theſe cyder is made, which conſtitutes the principal drink of the inhabitants; alſo, pears of various ſorts, quinces, peaches (from which is made peach brandy,) plums, cherries, apricots, &c. The culinary plants are ſuch as have already been enumerated. New England is a fine grazing country; the valleys between the hills are generally interſected with brooks of water, the banks of which are lined with a tract of rich meadow or interval land. The high and rocky ground is, in many parts, covered with honeyſuckle, and generally affords the fineſt of paſture. It will not be a matter of wonder, therefore, that New England boaſts of raiſing ſome of the fineſt cattle in the world; nor will ſhe be envied, when the labour of raiſing them is taken into view. Two months of the hotteſt ſeaſon in the year the farmers are employed in procuring food for their cattle; and the cold winter is ſpent in dealing it out to them. The pleaſure and profit of doing this, is however a ſatisfying compenſation to the honeſt and induſtrious farmer.

10 Population, manners, cuſtoms, and diverſions.

New England is the moſt populous part of the United States. It contains at leaſt 823,000 ſouls. One fifth of theſe are ſencible men. New England then, ſhould any great and ſudden emergency require it, could furniſh an army of 164,600 men. The great body of theſe are land-holders and cultivators of the ſoil. The former attaches them to their country; the latter, by making them ſtrong and healthy, enables them to defend it. The boys are early taught the uſe of arms, and make the beſt of ſoldiers. Few countries on earth, of equal extent and population, can furniſh a more formidable army than this part of the union. New England.

New England may, with propriety, be called a nurſery of men, whence are annually tranſplanted, into other parts of the United States, thouſands of its natives. The ſtate of Vermont, which is but of yeſterday, and contains about 100,000 ſouls, has received more inhabitants from Connecticut than from any other ſtate; and yet between the years 1774 and 1782, notwithſtanding her numerous emigrations to Vermont, Suſquehannah, and other places, and the depopulation occaſioned by a ſeven years bloody war, it is found, from an actual cenſus of the inhabitants in the years before-mentioned, that they have increaſed from 197,856, their number in 1774, to 290,150, their number in 1782. Vaſt numbers of the New Englanders, ſince the war, have emigrated into the northern parts of New York, into Kentucky and the Weſtern Territory, and into Georgia; and ſome are ſcattered into every ſtate, and every town of note in the union.

The New Englanders are generally tall, ſtout, and well built. They glory, and perhaps with juſtice, in poſſeſſing that ſpirit of freedom which induced their anceſtors to leave their native country, and to brave the dangers of the ocean and the hardſhips of ſettling in a wilderneſs. Their education, laws, and ſituation, ſerve to inſpire them with high notions of liberty. Their jealouſy is awakened at the firſt motion toward an invaſion of their rights. They are indeed often jealous to exceſs; a circumſtance which is a fruitful ſource of imaginary grievances, and of innumerable groundleſs ſuſpicions and unjuſt complaints againſt government. A law, reſpecting the deſcent of eſtates which are generally held in fee ſimple, which for ſubſtance is the ſame in all the New England ſtates, is the chief foundation and protection of this liberty. By this law, the poſſeſſions of the father are to be equally divided among all the children, excepting the eldeſt ſon, who has a double portion. In this way is preſerved that happy mediocrity among the people, which, by inducing economy and induſtry, removes from them temptations to luxury, and forms them to habits of ſobriety and temperance. At the ſame time, their induſtry and frugality exempt them from want, and from the neceſſity of ſubmitting to any encroachment on their liberties.

In New England, learning is more generally diffuſed among all ranks of people than in almoſt any other part of the globe; ariſing from the excellent eſtabliſhment of ſchools in every townſhip. Another ſource of information to the people is the newſpapers, of which not leſs than 30,000 are printed every week in New England, and circulated in almoſt every town and village in the country. A perſon of mature age, who cannot both read and write, is rarely to be found. By means of this general eſtabliſhment of ſchools, the extenſive circulation of newſpapers, and the conſequent ſpread of learning, every townſhip throughout the country is furniſhed with men capable of conduc-

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New England.

ting the affairs of their town with judgment and diſcretion. Theſe men are the channels of political information to the lower claſs of people; if ſuch a claſs may be ſaid to exiſt in New England, where every man thinks himſelf at leaſt as good as his neighbour, and believes that all mankind are, or ought to be, equal. The people from their childhood form habits of canvaſſing public affairs, and commence politicians. This naturally leads them to be very inquiſitive. This deſire after knowledge, in a greater or leſſer degree, prevails throughout all claſſes of people in New England: and from their various modes of expreſſing it, ſome of which are blunt and familiar, bordering on impertinence, ſtrangers have been induced to mention impertinent inquiſitiveneſs as a diſtinguiſhing characteriſtic of New England people.—Each man alſo has his independent ſyſtem of politics; and each aſſumes a dictatorial office. Hence originates that reſtleſs, litigious, complaining ſpirit, which forms a dark ſhade in the character of New Englandmen.

Before the American war, which introduced into New England a flood of corruptions, with many improvements, the Sabbath was obſerved with great ſtrictneſs; no unneceſſary travelling, no ſecular buſineſs, no viſiting, no diverſions, were permitted on that ſacred day. They conſidered it as conſecrated to divine worſhip, and were generally punctual and ſerious in their attendance upon it. Their laws were ſtrict in guarding the Sabbath againſt every innovation. The ſuppoſed ſeverity with which theſe laws were compoſed and executed, together with ſome other traits in their religious character, have acquired, for the New Englanders, the name of a ſuperſtitious bigotted people. But ſuperſtition and bigotry are ſo indefinite in their ſignifications, and ſo variouſly applied by perſons of different principles and educations, that it is not eaſy to determine how far they deſerved that character. Leaving every perſon to enjoy his own opinion in regard to this matter, we will only obſerve, that, ſince the war, a catholic tolerant ſpirit, occaſioned by a more enlarged intercourſe with mankind, has greatly increaſed, and is becoming univerſal; and if they do not break the proper bound, and liberalize away all true religion, of which there is much danger, they will counteract that ſtrong propenſity in human nature, which leads men to vibrate from one extreme to its oppoſite.

There is one diſtinguiſhing characteriſtic in the religious character of this people, which we muſt not omit to mention; and that is, the cuſtom of annually celebrating faſts and thankſgivings. In the ſpring, the ſeveral governors iſſue their proclamations, appointing a day to be religiouſly obſerved in faſting, humiliation, and prayer, throughout their reſpective ſtates, in which the predominating vices, that particularly call for humiliation, are enumerated. In autumn, after harveſt, that gladſome era in the huſbandman's life, the governors again iſſue their proclamations appointing a day of public thankſgiving, enumerating the public bleſſings received in the courſe of the foregoing year. This pious cuſtom originated with their venerable anceſtors, the firſt ſettlers of New England; and has been handed down as ſacred through the ſucceſſive generations of their poſterity. A cuſtom ſo rational, and ſo happily calculated to cheriſh in the minds of the people a ſenſe of their dependence on the great Benefactor of the world for all their bleſſings, it is hoped will ever be ſacredly preſerved.

New England.

The people of New England generally obtain their eſtates by hard and perſevering labour: They of conſequence know their value, and ſpend with frugality. Yet in no country do the indigent and unfortunate fare better. Their laws oblige every town to provide a competent maintenance for their poor; and the neceſſitous ſtranger is protected and relieved from their humane inſtitutions. It may in truth be ſaid, that in no part of the world are the people happier, better furniſhed with the neceſſaries and conveniences of life, or more independent than the farmers in New England. As the great body of the people are hardy independent freeholders, their manners are, as they ought to be, congenial to their employment, plain, ſimple, and unpoliſhed. Strangers are received and entertained among them with a great deal of artleſs ſincerity and friendly unformal hoſpitality. Their children, thoſe imitative creatures, to whoſe education particular attention is paid, early imbibe the manners and habits of thoſe around them; and the ſtranger, with pleaſure, notices the honeſt and decent reſpect that is paid him by the children as he paſſes through the country.

As the people, by repreſentation, make their own laws and appoint their own officers, they cannot be oppreſſed; and living under governments which have few lucrative places, they have few motives to bribery, corrupt canvaſſings, or intrigue. Real abilities and a moral character unblemiſhed are the qualifications requiſite in the view of moſt people for offices of public truſt. The expreſſion of a wiſh to be promoted is the direct way to be diſappointed.

The inhabitants of New England are generally fond of the arts, and have cultivated them with great ſucceſs. Their colleges have flouriſhed beyond any others in the United States. The illuſtrious characters they have produced, who have diſtinguiſhed themſelves in politics, law, divinity, the mathematics and philoſophy, natural and civil hiſtory, and in the fine arts, particularly in poetry, evince the truth of theſe obſervations.

Many of the women in New England are handſome. They generally have fair, freſh, and healthful countenances, mingled with much female ſoftneſs and delicacy. Thoſe who have had the advantages of a good education (and they are conſiderably numerous) are genteel, eaſy, and agreeable in their manners, and are ſprightly and ſenſible in converſation. They are early taught to manage domeſtic concerns with neatneſs and economy. Ladies of the firſt rank and fortune make it a part of their daily buſineſs to ſuperintend the affairs of the family. Employment at the needle, in cookery, and at the ſpinning-wheel, with them is honourable. Idleneſs, even in thoſe of independent fortunes, is univerſally diſreputable. The women in the country manufacture the greateſt part of the clothing of their families. Their linen and woollen cloths are ſtrong and decent. Their butter and cheeſe is not inferior to any in the world.

Dancing is the principal and favourite amuſement in New England; and of this the young people of both ſexes are extremely fond. Gaming is practiſed by none but thoſe who cannot or rather will not find a reputable employment. The gameſter, the horſe-jockey, and the knave, are equally deſpiſed, and their company is

avoided

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avoided by all who would ſuſtain fair and irreproachable characters. The odious and inhuman practices of duelling, gouging, cock-fighting, and horſe-racing, are ſcarcely known here.—The athletic and healthy diverſions of cricket, football, quoits, wreſtling, jumping, foot-races, &c. are univerſally practiſed in the country, and ſome of them in the moſt populous places, and by people of almoſt all ranks. Squirrel-hunting is a noted diverſion in country places, where this kind of game is plenty. Some divert themſelves with fox-hunting, and others with the more profitable ſports of fiſhing and duck-hunting; and in the frontier ſettlements, where deer and fur game abound, the inhabitants make a lucrative ſport of hunting them. In the winter ſeaſon, while the ground is covered with ſnow, which is commonly two or three months, ſleighing is the general diverſion. A great part of the families throughout the country are furniſhed with horſes and ſleighs.

11 Trade.

New England has no one ſtaple commodity. The ocean and the foreſts afford the two principal articles of export. Cod-fiſh, mackarel, ſhad, ſalmon, and other fiſh, whale-oil and whale-bone, maſts, boards, ſcantling, ſtaves, hoops, and ſhingles, have been and are ſtill exported in large quantities. The annual amount of cod and other fiſh for foreign exportation, including the profits ariſing from the whale-fiſhery, is eſtimated at upwards of half a million.—Beſides the articles enumerated, they export from the various parts of New England ſhips built for ſale, horſes, mules, live ſtock, pickled beef and pork, pot-aſh, pearl-aſh, flax-ſeed, butter and cheeſe, rum, &c. The balance of trade, as far as imperfect calculations will enable us to judge, has generally been againſt New England; not from any unavoidable neceſſity, but from her extravagant importations. From a view of the annual imports into New England, it appears that the greateſt part of them conſiſts of the luxuries, or at beſt the diſpenſable conveniences of life; the country affords the neceſſaries in great abundance.

ENGLISH, or the *English Tongue*, the language ſpoken by the people of England, and, with ſome variation, by thoſe of Scotland, as well as part of Ireland, and the reſt of the Britiſh dominions.

The ancient language of Britain is generally allowed to have been the ſame with the Gallic, or French; this iſland, in all probability, having been firſt peopled from Gallia, as both Cæſar and Tacitus affirm, and prove by many ſtrong and concluſive arguments, as by their religion, manners, cuſtoms, and the nearneſs of their ſituation. But now we have very ſmall remains of the ancient Britiſh tongue, except in Wales, Cornwall, the iſlands and highlands of Scotland, part of Ireland, and ſome provinces of France; which will not appear ſtrange, when what follows is conſidered.

Julius Cæſar, ſome time before the birth of our Saviour, made a deſcent upon Britain, though he may be ſaid rather to have diſcovered than conquered it; but about the year of Chriſt 45, in the time of Claudius, Aulus Plautius was ſent over with ſome Roman forces, by whom two kings of the Britons, Togodumnus and Caractacus, were both overcome in battle: whereupon a Roman colony was planted at Malden in Eſſex, and the ſouthern parts of the iſland were reduced to the form of a Roman province: after that, the iſland was conquered as far north as the friths of Dunbarton and Edinburgh, by Agricola, in the time of Domitian; whereupon a great number of the Britons, in the conquered part of the iſland, retired to the weſt part called *Wales*, carrying their language with them. English.

The greateſt part of Britain being thus become a Roman province, the Roman legions, who reſided in Britain for above 200 years, undoubtedly diſſeminated the Latin tongue; and the people being afterwards governed by laws written in Latin muſt neceſſarily make a mixture of languages. This ſeems to have been the firſt mutation the language of Britain ſuffered.

Thus the Britiſh tongue continued, for ſome time, mixed with the provincial Latin, till, the Roman legions being called home, the Scots and Picts took the opportunity to attack and haraſs England: upon which King Vortigern, about the year 440, called the Saxons to his aſſiſtance; who came over with ſeveral of their neighbours, and having repulſed the Scots and Picts, were rewarded for their ſervices with the iſle of Thanet, and the whole county of Kent; but growing too powerful, and not being contented with their allotment, diſpoſſeſſed the inhabitants of all the country on this ſide of the Severn *: thus the Britiſh tongue was in a great meaſure deſtroyed, and the Saxon introduced in its ſtead.

* See *England*, N° 13—42.

What the Saxon tongue was long before the conqueſt, about the year 700, we may obſerve in the moſt ancient manuſcript of that language, which is a gloſs on the Evangeliſts, by Biſhop Edfrid, in which the three firſt articles of the Lord's prayer run thus:

"Uren fader thic arth in heofnas, ſic gehalgud thin noma, ſo cymeth thin ric. Sic thin willa ſue is heofnas, and in eortho," &c.

In the beginning of the ninth century the Danes invaded England; and getting a footing in the northern and eaſtern parts of the country, their power gradually increaſed, and they became ſole maſters of it in about 200 years. By this means the ancient Britiſh obtained a tincture of the Daniſh language; but their government being of no long continuance, did not make ſo great an alteration in the Anglo-Saxon as the next revolution, when the whole land, A. D. 1067, was ſubdued by William the Conqueror, duke of Normandy in France: for the Normans, as a monument of their conqueſt, endeavoured to make their language as generally received as their commands, and thereby rendered the Britiſh language an entire medley.

About the year 900, the Lord's prayer, in the ancient Anglo-Saxon, ran thus:

"Thue ur fader the eart on heofenum, ſi thin nama gehalgod; cume thin rice ſithin will a on eorthan ſwa, ſwo on heofenum," &c.

About the year 1160, under Henry II. it was rendered thus by Pope Adrian, an Engliſhman, in rhyme:

"Ure fader in heaven rich,
"Thy name be halyed ever lich,
"Thou bring us thy michel bleſſe:
"Als hit in heaven y doe,
"Evar in yearth been it alſo," &c.

Dr Hicks gives us an extraordinary ſpecimen of the

English. Engliſh, as ſpoken in the year 1385, upon the very ſubject of the Engliſh tongue.

"As it is knowe how meny maner peple beeth in this lond; ther beeth alſo ſo many dyvers longages and tonges. Notheleſs Walſchemen and Scots that beeth nought medled with other nation, holdeth wel nyh hir firſte longage and ſpeche; but yif the Scottes, that were ſometime confederate and woned with the Pictes, drawe ſomewhat after hir ſpeche; but the Flemynges, that woneth on the weſt ſide of Wales, haveth loſt her ſtrange ſpeche, and ſpeketh Sexonliche now. Alſo Engliſhemen, they had from the bygynnynge thre maner ſpeche; northerne, ſoutherne, and middel ſpeche in the middel of the lond, as they come of thre maner of peple of Germania: notheleſs by commyxtion and meilynge firſt with Danes, and afterwards with Normans, in meny the contrary longage is apayred (*corrupted.*)

"This apayrynge of the burth of the tunge is bycauſe of tweie things; oon is for children in ſcole agenſt the uſuage and maner of all other nations, beeth compelled for to leve hir own longage, and for to conſtrue hir leſſons and here thinges in Frenſche, and ſo they haveth ſethe Normans come firſt into Engelond. Alſo gentlemen children beeth taught to ſpeke Frenſche from the tyme that they beeth roked in here cradel, and kunneth ſpeke and play with a childe's broche; and uplondiſſche men will lykne hymſelf to gentilmen, and fondeth with great beſyneſſe for to ſpeak Frenſche to be told of.—Hit ſeemeth a great wonder how Engliſchemen and hir own longage and tonge is ſo dyverſe of ſown in this oon iland; and the longage of Normandie is comlynge of another lond, and hath oon maner ſoun amonge alle men that ſpeketh hit arigt in Engelond. Alſo of the foreſaid Saxon tonge that is deled (*divided*) a three, and is abide ſcarceliche with fewe uplondiſſche men is greet wonder. For men of the eſt, with men of the weſt, is, as it were, undir the ſame partie of hevene accordeth more in ſownynge of ſpeche, than men of the north with men of the ſouth. Therefore it is that Mercii, that beeth men of myddel Engelond, as it were, parteners of the endes, underſtondeth bettre the ſide longes northerne and ſoutherne, than northerne and ſoutherne underſtondeth either other. —All the longage of the Northumbers and ſpechialliche at York, is ſo ſcharp, ſlitting, and frotynge, and unſchape, that we ſoutherne men may that longage unnethe underſtonde," &c.

In the year 1537, the Lord's prayer was printed as follows: "O oure father which arte in heven, hallowed be thy name: let thy kingdome come, thy will be fulfilled as well in erth as it is in heven; geve us this daye in dayly bred," &c. Where it may be obſerved, that the diction is brought almoſt to the preſent ſtandard, the chief variations being only in the orthography. By theſe inſtances, and many others that might be given, it appears, that the Engliſh Saxon language, of which the Normans deſpoiled us in a great meaſure, had its beauties, was ſignificant and emphatical, and preferable to what they impoſed on us. "Great, verily (ſays Camden), was the glory of our tongue before the Norman conqueſt, in this, that the old Engliſh could expreſs, moſt aptly, all the conceptions of the mind in their own tongue, without borrowing from any." Of this he gives ſeveral examples.

Having thus ſhown how the ancient Britiſh language was in a manner extirpated by the Romans, Danes, and Saxons, and ſucceeded by the Saxon, and after that the Saxon blended with the Norman French, we ſhall now mention two other cauſes of change in the language. The firſt of theſe is owing to the Britons having been a long time a trading nation, whereby offices, dignities, names of wares, and terms of traffic, are introduced, which we take with the wares from the perſons of whom we have them, and form them anew, according to the genius of our own tongue; and beſides this change in the language, ariſing from commerce, Britain's having been a conſiderable time ſubject to the ſee of Rome, in eccleſiaſtical affairs, muſt unavoidably have introduced ſome Italian words among us. Secondly, As to the particular properties of a language, our tongue has undergone no ſmall mutation, or rather has received no ſmall improvement upon that account: for, as to the Greek and Latin, the learned have, together with the arts and ſciences now rendered familiar among us, introduced abundance; nay, almoſt all the terms of art in the mathematics, philoſophy, phyſic, and anatomy; and we have entertained many more from the Latin, French, &c. for the ſake of neatneſs and elegancy; ſo that, at this day, our language, which, about 1800 years ago, was the ancient Britiſh, or Welch, &c. is now a mixture of Saxon, Teutonic, Dutch, Daniſh, Norman, and modern French, embelliſhed with the Greek and Latin. Yet this, in the opinion of ſome, is ſo far from being a diſadvantage to the Engliſh tongue as now ſpoken (for all languages have undergone changes, and do continually participate with each other), that it has ſo enriched it, as now to render it the moſt copious, ſignificant, fluent, courteous, and maſculine language in Europe, if not in the world.

English || Engraving.

ENGRAFTING, in *Gardening*. See GRAFTING, GARDENING *Index*.

ENGRAILED, or INGRAILED, in *Heraldry*, a term derived from the French *greſly*, "hail;" and ſignifying a thing the hail has fallen upon and broke off the edges, leaving them ragged, or with half rounds, or ſemicircles, ſtruck out of their edges.

ENGRAVING, the art of cutting metals and precious ſtones, and repreſenting thereon figures, letters, or whatever device or deſign the artiſt fancies.

Engraving, properly a branch of ſculpture, is divided into ſeveral other branches, according to the matter whereon it is employed, and the manner of performing it. For the rudeſt branch, that of

ENGRAVING on Wood, ſee *WOOD, Engraving on.*

ENGRAVING on Copper, the making, correſpondently to ſome delineated figure or deſign, ſuch concave lines on a ſmooth ſurface of copper, either by cutting or corroſion, as render it capable, when charged properly with any coloured fluid, of imparting by compreſſion an exact repreſentation of the figure or deſign to paper or parchment.

Whether we conſider the art of engraving, with regard to the utility and pleaſure it affords, or the difficulty that attends its execution, we cannot but confeſs, that on every account it deſerves a diſtinguiſhed rank among the polite arts †. It is by means of this art that the cabinets of the curious are adorned with the portraits of the greateſt men of all ages and all nations;

† See *Polite* ARTS, N° 13.

Engraving. tions; that their memories, their moſt remarkable and moſt glorious actions, are tranſmitted to the lateſt poſterity. It is by this art alſo, that the paintings of the greateſt maſters are multiplied to a boundleſs number; and that the lovers of the polite arts, diffuſed over the face of the whole earth, are enabled to enjoy thoſe beauties from which their diſtant ſituations ſeemed to have for ever debarred them; and perſons of moderate fortune are hereby enabled to become poſſeſſed of all the ſpirit, and all the poetry, that are contained in thoſe miracles of art, which ſeemed to have been reſerved for the temples of Italy, or the cabinets of princes. When we reflect, moreover, that the engraver, beſide the beauties of poetic compoſition, and the artful ordinance of deſign, is to expreſs, merely by the means of light and ſhade, all the various tints of colours and clair obſcure; to give a relief to each figure, and a truth to each object; that he is now to paint a ſky ſerene and bright, and then loaded with dark clouds; now the pure tranquil ſtream, and then the foaming, raging ſea; that here he is to expreſs the character of the man, ſtrongly marked in his countenance, and there the minuteſt ornament of his dreſs; in a word, that he is to repreſent all even the moſt difficult objects in nature; we cannot ſufficiently admire the vaſt improvements in this art, and that degree of perfection to which it is at this day arrived. See the article PRINTS.

Engraving is an art, for the greateſt part, of modern invention; having its riſe no earlier than the middle of the 15th century. The ancients, it is true, practiſed engraving on precious ſtones and cryſtals with very good ſucceſs; and there are ſtill many of their works remaining equal to any production of the later ages. But the art of engraving on plates and blocks of wood, to afford prints or impreſſions, was not known till after the invention of painting in oil.

The different modes of engraving are the following:

In ſtrokes cut through a thin wax, laid upon the copper, with a point, and theſe ſtrokes bitten or corroded into the copper with aquafortis. This is called *etching*.

In ſtrokes with the graver alone, unaſſiſted by aquafortis. In this inſtance, the deſign is traced with a ſharp tool, called a *dry point*, upon the plate; and the ſtrokes are cut or ploughed upon the copper with an inſtrument diſtinguiſhed by the name of a *graver*.

In ſtrokes firſt etched and afterwards finiſhed with the graver: by this expedient the two former methods are united.

In dots without ſtrokes, which are executed with the point upon the wax or ground, bitten in with the aquafortis, and afterwards harmonized with the graver, by the means of which inſtrument ſmall dots are made; or with the graver alone, as in the fleſh and finer parts, unaſſiſted with the point.

In dots firſt etched and afterwards harmonized with the dry point, performed by a little hammer, called *opus mallei*, or *the work of the hammer*, as practiſed by Lutma and others.

In mezzotinto, which is performed by a dark barb or ground being raiſed uniformly upon the plate with a toothed tool. The deſign being traced upon the plate, the light parts are ſcraped off by inſtruments for that purpoſe, in proportion as the effect requires.

In aquatinta, a newly invented method of engraving. The outline is firſt etched, and afterwards a ſort of waſh is laid by the aquafortis upon the plate, reſembling drawings in Indian ink, biſter, &c. Engraving

On wood, performed with a ſingle block, on which the deſign is traced with a pen, and thoſe parts which ſhould be white carefully hollowed out; and this block is afterwards printed by the letter-preſs printers, in the ſame manner as they print a book.

On wood, performed with two, three, or more blocks; the firſt having the outlines cut upon it; the ſecond is reſerved for the darker ſhadows; and the third for the ſhadows which terminate upon the lights; and theſe are ſubſtituted in their turn, each print receiving an impreſſion from every block. This mode of engraving is called *chiaro-ſcuro*, and was deſigned to repreſent the drawings of the old maſters.

On wood and on copper: in theſe the outline is engraved in a bold dark ſtyle upon the copper; and two or more blocks of wood are ſubſtituted to produce the darker and lighter ſhadows, as before.

Of all thoſe modes of engraving, the moſt ancient is that on *wood;* or, to ſpeak more properly, the firſt impreſſions on paper were taken from carved wooden blocks. For this invention it appears that we are indebted to the brief-maiers or makers of playing-cards, who practiſed the art in Germany about the beginning of the 15th century. From the ſame ſource may perhaps be traced the firſt idea of moveable types, which appeared not many years after: for theſe brief-maiers did not entirely confine themſelves to the printing and painting of cards, but produced alſo ſubjects of a more devout nature; many of which, taken from holy writ, are ſtill preſerved in different libraries in Germany, with the explanatory text facing the figures; the whole engraved in wood. In this manner they even formed a ſpecies of books; ſuch as, *Hiſtoria ſancti Johannis, ejuſque Viſiones Apocalypticæ; Hiſtoria Veteris et Novi Teſtamenti*, known by the name of the *Poor Man's Bible*. Theſe ſhort mementos were printed only on one ſide; and two of them being paſted together, had the appearance of a ſingle leaf. The earlieſt date on any of theſe wooden cuts is 1423. The ſubject is *St Chriſtopher carrying the Infant Jeſus over the Sea*, preſerved in a convent at Buxheim near Menningen. It is of a folio ſize, illuminated in the ſame manner as the playing cards; and at the bottom is this inſcription, *Chriſtoferi faciem die quacunque tueris. Illa nempe die morte mala non morieris. M.lleſimo CCCC° XX° tertio.*

Upon the invention of moveable types, that branch of the brief-maiers buſineſs, ſo far as it regarded the making of books, was gradually diſcontinued; but the art itſelf of engraving on wood continued in an improving ſtate; and towards the end of the 15th and beginning of the 16th century, it became cuſtomary for almoſt every one of the German engravers on copper to engrave on wood alſo. The works of Albert Durer in this ſtyle of engraving are juſtly held in the higheſt eſteem. Italy, France, and Holland, have produced many capital artiſts of this kind; but for boldneſs and ſpirit, we muſt ſee the prints of Chriſtopher Jegher, who worked under the direction of Rubens, and was without doubt aſſiſted by that great maſter. Strutt's *Hiſt of Engraving.*

The invention of that ſpecies of engraving diſtin-

Engraving. guiſhed by the appellation of *chiaro-ſcuro*, ſeems alſo to be juſtly claimed by the Germans, and firſt practiſed by Mair; one of whoſe prints of this kind is dated 1499. Many excellent works in chiaro-ſcuro have been produced in France; and in Italy it was honoured with the performances of Titian and Parmegiano; but the attempts of Jackſon, Kirkall, and others in England, have not been equally ſucceſsful. A ſet of excellent prints in this way have lately been publiſhed by J. Skippe, Eſq. a connoiſſeur and dillettante.

In Germany, about the year 1450, prints from engraved *copper* firſt made their appearance. The earlieſt date of a copperplate print is indeed only 1461; but however faulty this print may be with reſpect to the drawing, or defective in point of taſte, the mechanical part of the execution of it has by no means the appearance of being one of the firſt productions of the graver. We have alſo ſeveral other engravings, evidently the work of the ſame maſter; in which the impreſſions are ſo neatly taken from the plates, and the engravings ſo clearly printed in every part, that according to all appearance they could not be executed in a much better manner in the preſent day, with all the conveniences which the copperplate printers now poſſeſs, and the additional knowledge they muſt neceſſarily have acquired in the courſe of more than three centuries. Hence we may fairly conclude, that if they were not the firſt ſpecimens of the engraver's workmanſhip, they were much leſs the firſt efforts of the copperplate printer's ability. It is likewiſe to be obſerved, that Martin Schoen, who is ſaid, with great appearance of truth, to have worked from 1460 to 1486, was apparently the ſcholar of Stoltzhirs; for he followed his ſtyle of engraving, and copied from him a ſet of prints, repreſenting the paſſion of our Saviour. Now, allowing Stoltzhirs to have preceded his diſciple only ten years, this carries the era of the art back to 1450, as was ſaid above. There is no ground to ſuppoſe that it was known to the Italians till at leaſt ten years afterwards. The earlieſt prints that are known to be theirs are a ſet of the ſeven planets, and an almanack by way of frontiſpiece; on which are directions for finding Eaſter from the year 1465 to 1517 incluſive: and we may be well aſſured, that the engravings were not antedated, for the almanack of courſe became leſs and leſs valuable every year. In all probability, therefore, theſe prints muſt have been executed in the year 1464, which is only four years later than the Italians themſelves lay any claim to. The three earlieſt Italian engravers are, Finiguerra, Boticelli, and Baldini. If we are to refer theſe prints to any of the three, we ſhall naturally conclude them to be the work of Finiguerra or Baldini; for they are not equal either in drawing or compoſition to thoſe aſcribed to Boticelli, which we know at leaſt were deſigned by him; and as Baldini is expreſsly ſaid to have worked from the deſigns of Boticelli, it will appear moſt probable that they belong to Finiguerra.

Strutt's Hiſt. of Engraving.

With reſpect to the invention of *etching*, it ſeems to be not well known to whom it is to be aſcribed. One of the moſt early ſpecimens is that print by Albert Durer, known by the name of the *Canon*, dated 1518, and thought by ſome, with little foundation, to have been worked on a plate of iron. Another etching by the ſame artiſt is Moſes receiving the Tables of the Law, dated 1524. It was alſo practiſed in Italy ſoon after this by Parmegiano, in whoſe etchings we diſcover the hand of the artiſt working out a ſyſtem as it were from his own imagination, and ſtriving to produce the forms he wanted to expreſs. We ſee the difficulty he laboured under; and cannot doubt, from the examination of the mechanical part of the execution of his works, that he had no inſtruction; and that it was ſomething entirely new to him. If the ſtory is true, that he kept an engraver by profeſſion in his houſe, the novelty of the art is rendered ſo much the more probable. He died in 1540. Engraving.

As to that ſpecies of engraving in which the modes of *etching* and *cutting* with the graver are united, it muſt have been found neceſſary immediately upon the invention of etching; it was, however, firſt carried to perfection by G. Audran, and is now almoſt univerſally practiſed, whether the work is in ſtrokes or in dots.

Engraving in *dots*, the preſent faſhionable method, is a very old invention, and the only mode diſcovered by the Italians. Agoſtino de Muſis, commonly called *Auguſtine of Venice*, a pupil of Marc Antonio, uſed it in ſeveral of his earlieſt works, but confined it to the fleſh, as in the undated print of An Old Man ſeated upon a Bank, with a cottage in the back ground. He flouriſhed from 1509 to 1536. We alſo find it in a print of "A ſingle figure ſtanding, holding a cup and looking upwards," by Giulio Campagnola, who engraved about the year 1516. The back ground is executed with round dots, made apparently with a dry point. The figure is outlined with a ſtroke deeply engraved, and finiſhed with dots, in a manner greatly reſembling thoſe prints which Demarteau engraved at Paris in imitation of red chalk. The hair and beard are expreſſed by ſtrokes. Stephen de Laulne, a native of Germany, followed the ſteps of Campagnola; and many of his ſlight works are executed in dots only. John Boulanger, a French artiſt, who flouriſhed in the middle of the laſt century, and his cotemporary Nicholas Van Plattenberg, improved greatly on this method, and practiſed it with much ſucceſs. It is only, however, of late, that it has been conſidered as an object worthy of general imitation. John Lutma executed this kind of work with a hammer and a ſmall punch or chiſſel.

The method of engraving in *mezzotinto* was invented about the middle of the 17th century; and the invention has generally been attributed to Prince Rupert, though it has alſo been aſſerted that he learnt the ſecret from another. See MEZZOTINTO.

OF the method of engraving in aquatinta, a ſhort and general account has already been given under that word. See AQUATINTA. But as ſome farther information relating to this branch of the art of engraving has fallen in our way, we embrace this opportunity of laying it before our readers.

Engraving in aquatinta, was originally invented by Le Prince, a French artiſt. For a long time, his proceſs was kept ſecret; and his prints, it is ſaid, were at firſt ſold for drawings. As a proof that the art roſe at once to perfection, as has already been mentioned, the prints

Engraving. prints which were executed by him, are ſtill admired as the fineſt and beſt ſpecimens of the art. It appears, however, that he was only acquainted with the powdered grain, and the common method of ſtopping out. The firſt who practiſed this art in England, was Mr Paul Sandby. By him, we are informed, it was communicated to Mr Jukes, whoſe works afford excellent examples to what perfection the art has been carried; and although it is now generally practiſed all over Europe, yet in no country with greater ſucceſs than in Britain.

The principle of this proceſs conſiſts in corroding the copper in ſuch a manner, that an impreſſion from it exhibits the appearance of a tint laid on paper, or a drawing in Indian ink. This is accompliſhed by covering the copper with ſome ſubſtance which aſſumes a granulated form, and prevents the acid from acting where the particles adhere; and thus the copper is only partially corroded. The more minute the particles are, it is obvious the impreſſion from the plate will more nearly reſemble a waſh of Indian ink, or a drawing; but the larger the particles are, the granulation becomes more diſtinct. The powder or granulation is called the *aquatinta grain*. It is produced in two ways.

The proceſs for uſing the powdered grain, which was firſt employed, is the following. The outline being etched on a copper plate, ſome ſubſtance which eaſily melts with heat, adheres to the plate when cold, and reſiſts the action of the aquafortis, is to be finely powdered and ſifted. Beſides aſphaltum, roſin, and gum ſandarac, the ſubſtances which have been mentioned in the article already referred to, Burgundy pitch, gum copal, gum maſtic, as well as ſome other reſins and gum reſins, may be employed. Gum copal, it is obſerved, produces a grain which reſiſts the aquafortis extremely well. Whatever the ſubſtance is which is to be employed, the great object of the artiſt in its application is, to have it equally diſtributed over the plate. This is an eſſential part of the operation, and requires conſiderable attention. The uſual method is, to tie up a quantity of the powder in a piece of muſlin, and to ſtrike it againſt a ſtick held at a conſiderable height above the plate. Thus managed, the powder ſettles equally over it, in the ſame uniform manner that hair powder ſettles on the furniture of an apartment, where the operations of the hair-dreſſer are performed. The plate being thus covered equally with the duſt or powder, it is to be fixed upon it, by the application of a gentle heat, to melt the particles. This is uſually done by holding lighted pieces of brown paper, rolled up, and moving them about till the whole of the powder is melted, which is known by its changing to a brown colour. It is now allowed to cool and after being examined with a magnifying glaſs, if the particles appear to be uniformly diſtributed, the artiſt proceeds to the next part of the proceſs.

Thoſe parts of the deſign or drawing to be engraved, which are perfectly white, are to be obſerved and marked, and the correſponding parts of the plate muſt be covered or ſtopped out. This is beſt done by means of maſtic varniſh, diluted to ſuch a conſiſtence with turpentine as to work freely with the pencil. To give it colour, lamp-black ſhould be mixed with it, that the touches of the pencil may be diſtinctly ſeen. When thoſe parts of the plate which are ſtopped out, are ſufficiently dry, a border of wax is raiſed round the plate, in the ſame manner as in etching, and the aquafortis diluted with water is poured on. This being the moſt precarious part of the proceſs, requires the greateſt experience. When it is ſuppoſed that the aquafortis has remained on the plate for ſuch a length of time, that when an impreſſion is taken, it will produce the lighteſt ſhade in the drawing, it is poured off, and the plate is waſhed with water and dried. The lighteſt tints are then ſtopped out, and the aquafortis is again poured on; and this proceſs is repeated as often as there are tints or ſhades to be produced in the plate. Engraving.

Many plates are entirely etched in this way, by alternately ſtopping out and biting in. It is, however, found to be extremely difficult, and indeed impoſſible, to produce impreſſions of minute and complicated objects with the requiſite degree of delicacy and freedom. To obviate this difficulty, another proceſs has been propoſed, by which the touches are laid on the plate, with equal eaſe and expedition as on drawings with Indian ink. Fine waſhed whitening is mixed with treacle or ſugar, and diluted with water in the pencil, that it may work freely. This is laid on the plate covered with the aquatint ground, in the ſame way as ink on the drawing. When this is dry, the whole of the plate is varniſhed over with a thin turpentine or maſtic varniſh, and when this is dry, the aquafortis is poured on. The varniſh immediately breaks up in thoſe parts of the plate where the treacle mixture was laid, and thus they are expoſed to the action of the acid, while the other parts of the plate remain untouched. Thus the touches or places of the plate where the treacle has been applied, are bit in deeper than the reſt, and have the preciſion of touches done with Indian ink. The plate being thus completely bit in, the bordering wax is removed, by gently heating it with a piece of lighted paper. It is then cleared from the ground, and varniſhed by means of oil of turpentine; and being wiped clean with a rag and a little fine whitening, it is ready for the printer.

But in this method of aquatinting, it is found difficult to produce the neceſſary degree of coarſeneſs or fineneſs in the grain; and plates which are engraved in this manner afford but a ſmall number of impreſſions before they are worn out. On this account it is now more rarely followed.

The other method of producing the aquatint ground, which is moſt generally adopted, is the following. A reſinous ſubſtance, as common reſin, Burgundy pitch, or maſtic, is diſſolved in ſpirits of wine. This ſolution is poured all over the plate, which is inclined, till the whole of the ſuperfluous fluid drains off, and what adheres to the plate becomes quite dry in a few minutes. The plate being then examined with a magnifying glaſs, it will appear that the whole of the ſpirit having evaporated, the reſinous matter is left in a granulated ſtate, or is cracked in every direction, and adheres ſtrongly to the copper. In this way a regular and beautiful grain is eaſily produced, which will be found preferable, at leaſt for moſt purpoſes, to that which is produced by the former method. The grain being thus formed, the other parts of the proceſs are conducted in the ſame manner as before deſcribed.

Such

Engraving. Such are the usual methods of conducting this process. We shall add a few hints which the young artist may find useful in the different parts of it. With regard to the materials which are employed, it is to be observed, that the spirits of wine should be rectified, and of the best quality. Resinous matters, as common resin, Burgundy pitch, and gum mastic, yield grains of a different appearance and form; so that advantage may be taken of this circumstance, by using them sometimes separately, and sometimes mixed in different proportions, according to the views and taste of the artist. Different proportions of resin may be employed, to produce grains of different kinds. When a coarse grain is intended, a greater proportion is to be employed; and when a fine grain is wanted, a smaller proportion of resin only is required. The proper proportions may be ascertained by providing a number of spare pieces of copper; on these the liquid may be poured, and the grain examined, before it is applied to the plate which is to be engraved. After the solution is made, it should remain undisturbed for a day or two, till the impurities of the resin have subsided, and the liquid becomes quite limpid. This is the best method of freeing it from impurities; for if it is strained through linen or muslin, it is mixed with hairs, which are extremely injurious to the grain. It may be added, that the apartment in which the fluid is poured on the plate, should be perfectly still, and entirely free from dust; for if any fall on the plate while it is wet, the grain forms a white spot which cannot be removed. Great care should be observed in cleaning the plate. This is done with a bit of rag and whitening. The smallest stain or particle of grease produces a streak or blemish in the grain. Still, however, with all the attention which can be employed, and with the utmost delicacy in the management, it is necessary to observe, that the process is extremely precarious and uncertain; and even the most experienced artists find themselves frequently subject to very unaccountable accidents.

Artists have frequently complained of the inconvenience from the fumes which proceed from the action of the acid upon the copper, when the plate is large. *Phil. Mag.* vol xxiii. 237. "To remedy this inconvenience, the following arrangement, which seems well calculated to answer the purpose, has been suggested by Mr Cornelius Varley, a young artist who distinguishes himself no less by his mechanical abilities than by the exquisite productions of his pencil in water colours.—Get a frame made of common deal or any kind of wood, three or four inches deep, covered with a plate of glass, and open at one side; and let the side opposite to this have a round opening communicating, by means of a common iron pipe, with the ashpit of any little stove or other fire-place, shut up from all other access of air but what must pass through the pipe. It is obvious that any fumes rising from a copper-plate laid under such a frame will be carried backward into the iron pipe by the current of air required to maintain combustion in the stove, and will by this means be carried up the chimney in place of being allowed to fly about in the apartment. The pipe may be very conveniently used by carrying it down through the table to the floor, and so along to the place where the chimney may chance to stand; and when the frame is not wanted, the pipe at one of the joinings may be made to answer the purpose of a hinge, by which to turn up the frame against the wall where it may be secured, while out of use, by a button or any other contrivance." Engraving.

This method of engraving in aquatinta seems to be chiefly adapted for slight subjects in general, for imitations of sketches, and washed drawings. But for the production of prints from finished pictures, it is by no means calculated; because it is not susceptible of that accuracy in the nice management of the tints which is necessary for this purpose. It is equally unsuitable for book plates; because, without retouching the plates, the number of impressions that can be thrown off is very small. On these accounts, therefore, it is to be considered greatly inferior to the other modes of engraving. But as it is more expeditious, and may be attained with more facility, it is undoubtedly useful when it is confined to those subjects for which it is peculiarly calculated. This rapidity of execution, however, and facility in acquiring the practice of the art, are followed with the unfortunate circumstance, that they favour the production of an indiscriminate multitude of prints which, it is to be feared, may rather tend to vitiate the public taste.

Engraving with the tool was the kind originally practised, and it is yet retained for many purposes. For though the manœuvre of etching be more easy, and other advantages attend it; yet where great regularity and exactness of the stroke or lines are required, the working with the graver is much more effectual: on which account it is more suitable to the precision necessary in the execution of portraits: as there every thing the most minute must be made out and expressed, according to the original subject, without any license to the fancy of the designer in deviating from it, or varying the effect either by that masterly negligence and simplicity in some parts, or those bold sallies of the imagination and hand in others, which give spirit and force to history-painting.

The principal instruments used in engraving with the tool are, gravers, scrapers, a burnisher, an oil-stone, and a cushion for bearing the plates.

Gravers are made in several forms with respect to the points, some being square, others lozenge; the square graver for cutting broad and deep, and the lozenge for more delicate and fine strokes and hatches. La Bosse recommends, as the most generally useful, such as are of a form betwixt the square and lozenge: and he advises, that they should be of a good length; small towards the point, but stronger upwards, that they may have strength enough to bear any stress there may be occasion to lay upon them: for if they be too small and mounted high, they will bend; which frequently causes their breaking, especially if they be not employed for very small subjects.

The burnisher is used to assist in the engraving on some occasions, as well as to polish the plates. It is seven inches in length, and made of fine steel well polished. The burnisher is formed at one end, and a scraper on the other, each about an inch and a half long from the point: betwixt them, about four inches of the instrument is made round, and serves as a handle; and is thicker in the middle than at the necks, where the burnisher and scraper begin, which necks are only one quarter of an inch in diameter. The princi-

pal

Engraving. pal application of it in engraving, beſides its uſe in poliſhing the plates, is to take out any ſcratches or accidental defacings that may happen to the plates during the engraving; or to leſſen the effect of any parts that may be too ſtrongly marked in the work, and require to be taken down.

A cuſhion, as it is called, is likewiſe generally uſed for ſupporting the plate in ſuch a manner, that it may be turned every way with eaſe. It is a bag of leather filled with ſand, which ſhould be of the ſize that will beſt ſuit the plates it is intended to bear. They are round, and about nine inches over, and three inches in thickneſs.

The cuſhion, made as above directed, being laid on the table, the plate muſt be put upon it; and the graver being held in the hand in a proper manner, the point muſt be applied to the plate, and moved in the proper direction for producing the figures of the lines intended: obſerving, in forming ſtraight lines, to hold the plate ſteady on the cuſhion; and where they are to be finer, to preſs more lightly, uſing greater force where they are to be broader and deeper. In making circular or other curve lines, hold your hand and graver ſteadily; and as you work, turn your plate upon the cuſhion againſt your graver, otherwiſe it will be impoſſible for you to make any circular or curved line with that neatneſs and command of hand you by this means may. After part of the work is engraved, it is neceſſary to ſcrape it with the ſcraper or graver, paſſed in the moſt level direction over the plate, to take off the roughneſs formed by the cutting of the graver; but great care muſt be taken not to incline the edge of the ſcraper or tool uſed, in ſuch a manner that it may take the leaſt hold of the copper, as it would otherwiſe produce falſe ſtrokes or ſcratches in the engraving: and that the engraved work may be rendered more viſible, it may afterwards be rubbed over with a roll of felt dipped in oil. In uſing the graver, it is neceſſary to carry it as level as poſſible with the ſurface of the plate; for otherwiſe, if the fingers ſlip betwixt them, the line that will be produced, whether curve or ſtraight, will become deeper and deeper in the progreſs of its formation; which entirely prevents ſtrokes being made at one cut, that will be fine at their extremities, and larger in the middle; and occaſions the neceſſity of retouching to bring them to that ſtate. For this reaſon, it is very neceſſary for thoſe who would learn to engrave in perfection, to endeavour, by frequent trials, to acquire the habit of making ſuch ſtrokes both ſtraight and curving, by lightening or ſinking the graver with the hand, according to the occaſion. If, after finiſhing the deſign, any ſcratches appear, or any part of the engraving be falſely executed, ſuch ſcratches, or faulty parts, muſt be taken out by the burniſher, and further poliſhed, if neceſſary, by the above-mentioned roll.

The plate being thus engraved, it is proper to round off the edges, by uſing firſt a rough file, and afterwards a ſmoother; and to blunt the corners a little by the ſame means: after which, the burniſher ſhould be paſſed over the edges to give it a farther poliſh.

The dry point, or needle, which has been of late much uſed in engraving, is a tool like an etching point, which being drawn hard on the copper, cuts a ſtroke, and raiſes a burr; the burr is ſcraped off, and there remains a ſtroke more ſoft and delicate than can be produced in any other way. Engraving.

In the conduct of the graver and dry point conſiſts all the art; for which there are no rules to be given; all depending on the habitude, diſpoſition, and genius, of the artiſt. However, beſides the explanations already given, ſome general obſervations and directions may not be improper. As the principles of engraving are the ſame with thoſe of painting, a perſon cannot expect to attain any conſiderable degree of perfection in this art who is not a good maſter of deſign; and therefore he ought to be well acquainted both with perſpective and architecture: for the former, by the proper degradations of ſtrong and faint colours, will enable him to throw backwards the figures and other objects of the picture or deſign which he propoſes to imitate; and the latter will teach him to preſerve the due proportion of its ſeveral orders, which the painter often entruſts to the diſcretion of the engraver. In order to preſerve equality and union in his works, the engraver ſhould always ſketch out the principal objects of his piece before he undertakes to finiſh them. In working, the ſtrokes of the graver ſhould never be croſſed too much in a lozenge manner, particularly in the repreſentation of fleſh, becauſe ſharp angles produce the unpleaſing effect of lattice-work, and take from the eye the repoſe which is agreeable to it in all kinds of picturеſque deſigns: we ſhould except the caſe of clouds, tempeſts, waves of the ſea, the ſkins of hairy animals, or the leaves of trees, where this method of croſſing may be admitted. But in avoiding the lozenge, it is not proper to get entirely into the ſquare, which would give too much of the hardneſs of ſtone. In conducting the ſtrokes, the action of the figures, and of all their parts, ſhould be conſidered; and it ſhould be obſerved how they advance towards, or recede from the eye; and the graver ſhould be guided according to the riſings or cavities of the muſcles or folds, making the ſtrokes wider and fainter in the light, and cloſer and firmer in the ſhades. Thus the figures will not appear jagged; and the hand ſhould be lightened in ſuch a manner, that the outlines may be formed and terminated without being cut too hard; however, though the ſtrokes break off where the muſcle begins, yet they ought always to have a certain connection with each other, ſo that the firſt ſtroke may often ſerve by its return to make the ſecond, which will ſhow the freedom of the engraver.

In engraving the fleſh, the effect may be produced in the lighter parts and middle tints by long pecks of the graver, rather than by light lines; or by round dots; or by dots a little lengthened by the graver; or, beſt of all, by a judicious mixture of theſe together.

In engraving the hair and the beard, the engraver ſhould begin his work by laying the principal grounds, and ſketching the chief ſhades in a careleſs manner, or with a few ſtrokes; and he may finiſh it at leiſure with finer and thinner ſtrokes to the extremities. When architecture or ſculpture is to be repreſented, except it be old and ruinous buildings, the work ought not to be made very black; becauſe, as edifices are commonly conſtructed either of ſtone or white marble, the

Engraving. the colour, being reflected on all ſides, does not produce dark or brown ſhades as in other ſubſtances. White points muſt not be put in the pupils of the eyes of figures, as in engravings after paintings; nor muſt the hair or beard be repreſented as in nature, which makes the locks appear flowing in the air; becauſe in ſculpture there can be no ſuch appearances.

In engraving cloths of different kinds, linen ſhould be done with finer and cloſer lines than any other ſorts, and be executed with ſingle ſtrokes. Woollen cloth ſhould be engraved wide, in proportion to the coarſeneſs or fineneſs of the ſtuff, and with only two ſtrokes; and when the ſtrokes are croſſed, the ſecond ſnould be ſmaller than the firſt, and the third than the ſecond. Shining ſtuffs, which are generally of ſilk or ſatin, and which produce flat and broken folds, ſhould be engraved more hard and more ſtraight than others, with one or two ſtrokes, as their colours are bright or brown; and between the firſt ſtrokes other ſmaller muſt be joined, which is called interlining. Velvet and pluſh are expreſſed in the ſame manner, and ſhould always be interlined. Metals, as armour, &c. are alſo repreſented by interlining, or by clear ſingle ſtrokes. In architecture, the ſtrokes which form the rounding object ſhould tend to the point of ſight; and when whole columns occur, it is proper to produce the effect as much as poſſible by perpendicular ſtrokes. If a groſs ſtroke is put, it ſhould be at right angles, and wider and thinner than the firſt ſtroke. In engraving mountains, the ſtrokes ought to be frequently diſcontinued and broken, for ſharp and craggy objects; and they ſhould be ſtraight, in the lozenge manner, and accompanied with long points or dots; and rocks ſhould be repreſented by croſs ſtrokes more ſquare and even. Objects that are diſtant towards the horizon ſhould be kept very tender, and ſlightly charged with black. Waters that are calm and ſtill are beſt repreſented by ſtrokes that are ſtraight, and parallel to the horizon, interlined with thoſe that are finer: omitting ſuch places as, in conſequence of gleams of light, exhibit the ſhining appearance of water; and the form of objects reflected from the water at a ſmall diſtance upon it, or on the banks of the water, are expreſſed by the ſame ſtrokes, retouched more ſtrongly or faintly as occaſion may require, and even by ſome that are perpendicular. For agitated waters, as the waves of the ſea, the firſt ſtrokes ſhould follow the figure of the waves, and may be interlined, and the croſs ſtrokes ought to be very lozenge. In caſcades, the ſtrokes ſhould follow the fall, and be interlined. In engraving clouds, the graver ſhould ſport when they appear thick and agitated, in turning every way according to their form and their agitation. If the clouds are dark, ſo that two ſtrokes are neceſſary, they ſhould be croſſed more lozenge than the figures, and the ſecond ſtrokes ſhould be rather wider than the firſt. The flat clouds, that are loſt inſenſibly in the clear ſky, ſhould be made by ſtrokes parallel to the horizon, and a little waving; if ſecond ſtrokes are required, they ſhould be more or leſs lozenge; and when they are brought to the extremity, the hand ſhould be ſo lightened, that they may form no outline. The flat and clear ſky is repreſented by parallel and ſtraight ſtrokes, without the leaſt turning. In landſcapes, the trees, rocks, earth, and herbage, ſhould be etched as much as poſſible; nothing Engraving. ſhould be left for the graver but perfecting, ſoftening, and ſtrengthening. The dry point produces an effect more delicate than the graver can, and may be uſed to great advantage in linen, ſkies, diſtances, ice, and often in water, eſpecially in ſmall engravings. In moſt things it is proper to etch the ſhadows, only leaving the lighter tints for the dry point, graver, &c.

To imitate *chalk-drawings*, a mixture of varied and irregular dots are uſed, made more or leſs ſoft, ſo as to reſemble the grain produced by the chalks on paper. Every ſtroke of the chalks on paper may be conſidered as an infinite number of adjoining points, which are the ſmall eminences of the grain of the paper touched by the chalk in paſſing over it. When the copperplate has been poliſhed and varniſhed, or properly prepared, as in the common method of engraving, the drawing to be imitated may be counterproved on the varniſh of the plate. If this cannot be conveniently done, black lead pencil, or red chalk, muſt be applied to varniſhed or oiled paper; and by means of this chalk or pencil, all the traces of the original will be tranſmitted to the varniſh. The outlines of the object muſt be formed in the etching by points, whoſe magnitude and diſtance muſt be determined by the quality of the ſtrokes in the original drawing. The artiſt may be provided with pointed inſtruments or needles of various ſizes with ſingle or double points. In forming the light and ſhade, he ſhould diſtinguiſh between thoſe hatches which ſerve to expreſs the perſpective of the object and thoſe which form the ground of it. The principal hatches ſhould be more ſtrongly marked; the middle tints, if etched, ſhould be marked lightly, or they may be left till the varniſh is taken off, and be perfected with a greater degree of ſoftneſs by needles or the point of the graver, as the original may require. There is nothing peculiar in the method of applying the aquafortis in this kind of engraving; but it may be obſerved, that it ſhould not be left ſo long as to corrode the lighter parts too much: if the light parts are ſufficiently corroded, they may be ſtopped up with turpentine varniſh and lamp-black mixed together, and the aquafortis may be applied again to the ſtronger parts; for it will be no detriment to them, if the points which compoſe the ſhade burſt into one another, provided the extreme be avoided. When the work of the aquafortis is finiſhed, and the varniſh taken off the copper, it will be neceſſary in the ſofteſt parts, ſuch as the fleſh, &c. to interſlipple with proper points; as an effect will be thus produced more delicate than it is poſſible to attain with the aquafortis only; and the ſtrongeſt ſhades will require additional ſtrength to be given them with ſmall ſtrokes of the graver. Drawings made with chalks of different colours may be imitated in this manner, if a plate be provided for every colour.—This method of engraving is intended to form a kind of deception, ſo that the connoiſſeur may not be able, on the firſt inſpection, to diſtinguiſh between the original drawing and the engraving made in imitation of it; and it is extremely uſeful, as it ſerves to multiply copies of drawings left by thoſe maſters who excelled in the uſe of chalks, and thus to form and improve young artiſts, who could not have acceſs to the originals in the practice of drawing.

Engraving.

To this account of the hiſtory and practice of the art of engraving, we ſhall annex the following ingenious obſervations by an eminent living artiſt (A). We preſent them to our readers without alteration or abridgement.

On the linear art in general.

WHEN compared with painting, the art of engraving is but a recent invention, being coeval only with that of printing; and like that noble art, it poſſeſſes not only a ſimilar but a greater power, of multiplying and extending the productions of genius over the world; for its language is univerſally underſtood.

It would have been well for the arts, if it could boaſt of a more remote date, as we might then have had many more of the fineſt deſigns of the firſt painters of antiquity, now doomed to oblivion, ſaved from the rude ravages of time.

But this invention ſeemed to be reſerved for the fourteenth century, and its improvements for the age of Louis XIV. an age in which a number of artiſts, who may be ſaid to have invigorated the art, and inveiled it with beauty, aroſe both in France and Italy.

Lines, in the firſt ſtate of the art, like every other purſuit, whoſe excellence is progreſſive, were comparatively rude and unmeaning, and had nothing more to recommend them, than merely repreſenting a particular ſort of markings, or ſlight hatchings with the pen, without any other apparent degree of execution or expreſſion. Although it is our pride to acknowledge, that it has not been a little beholden to the elegant etchings of the great maſters in painting, as well as to their drawings in pen and ink, in its early ſtages, by which means an eminent degree of taſte was introduced into the art, particularly in the department of linear diſpoſition. Amongſt thoſe, the drawings of a Raphael, Michael Angelo, and the learned da Vinci; ſome of which we have occaſionally ſeen and admired. Some by da Vinci were hatched in a ſquare but delicate manner, with a white fluid, on dark coloured paper. Thoſe of Michael Angelo and Raphael inclined more to the lozenge, in black or brown ink. They even carried this ſtyle of hatching with the pencil into their pictures, ſome of which adorn the Vatican; and in the famous cartoons in his majeſty's collection by Raphael. Baccio Bandinelli generally hatched his lines in one direction, particularly a Taking down from the Croſs, which was ſold in London at the ſale of the late Sir Joſhua Reynold's drawings. Vicenzio Dante, hatched in a ſimilar way about the year 1550. Julio Romano uſed alſo to draw in this ſtyle with the pen, ſeverals of which are ſtill to be found in the moſt ſelect cabinets of men of taſte; and for near a century and a half after the invention of etching, it is rare to mention a painter of eminence, who was diſtinguiſhed in drawing, who did not annex this art to that of painting. But with the application of the burin, the art has been gradually improving till the preſent period. (B) Linear engraving is nothing more than drawing elegantly on copper. It became more ſtudied as it was found capable of repreſenting the various appearances of nature. The texture or ſurface of objects became proportionally diſcriminated by ſuch peculiar modifications of the line, as ſeemed moſt ſuitable to the ſubject repreſented, although, at the ſame time, it rendered it much more arduous in the execution. Hence aroſe that diverſity of ſtyle, and that ſcope for ſucceeding excellence, which, by combining elegance with ſimplicity and beauty, diſtinguiſhed thoſe artiſts who have been moſt conſpicuous in its improvement. Engraving.

It has been ſaid, that we are indebted for the origin of this art to an ingenious Florentine, Maſo Finiguerra, the ſculptor. He was ſucceeded by a number of other ingenious men, among whom we rank Botticelli, Andrea Mantigna, and other able deſigners;—and in Germany, Albert Durer, Aldgrave, and Lucas Van Leyden, who ſeverally contributed their labours. But in the fifteenth century, the works of the divine Raphael began to be multiplied by the correct graver of Marc Antonio, an artiſt whoſe prints were the delight of that great painter. Antonio had many imitators, but none who equalled him for juſtneſs of contour, for which his works will be ever highly appreciated among the early productions of the art.—Having had occaſion to mention a few of the principal artiſts who reared the ſcaffolding of this elegant art, we ſhall proceed to thoſe who have ſo much diſtinguiſhed themſelves in finiſhing the ſuperſtructure. Among thoſe, Auguſtino of Venice began to introduce a better diſpoſition of line in his ſhades, as well as the ingenious Bologneſe, Auguſtino Carrachi; whilſt Egedius Sadelaer diſplayed no leſs zeal in Germany. In the ſixteenth century, the art diſplayed ſtill more vigour and taſte, and ſeemed to have but little more wanting; for all that meagre dryneſs of line began to diſappear, which ſo manifeſtly marks the early works of Il Tedeſca, Aldegraff, and other artiſts of a former period. Their works became conſequently more rich in ſtyle, by embracing the beſt productions of the pencil; and as they were applied to a greater number of ideas, they became ſtill more intereſting and ſucceſsful.

Patrons were numerous and liberal; and it is but proper to remark, that the various artiſts, on their part, actuated by a becoming zeal which was highly creditable to themſelves, were indefatigable. This is a circumſtance not leſs worthy of imitation, than the many admirable monuments of the art which they produced. Few but admired the works of Maſſon, Poilly, Nantueil, and Rouſſelet; and ſome time after the death of the ingenious Cornelius Bloemart, who had given a grace to his lines, hitherto unknown at Rome, the matchleſs Audran and Edelinck diſplayed their excellent productions at Paris. But arts are liable to fluctuate; and when the art of engraving began to decline abroad, it gradually diſplayed a high degree of luſtre in our own country; and the variety of ſtyles which has ſince ſprung from the original manner of engraving ſhall be the ſubject of the following ſketch.

We ſhall therefore treat more particularly of the diſpoſition of the lines and their conſequent effects, diſtinguiſhed

(A) Francis Legat, Eſq. hiſtorical engraver to his royal highneſs the prince of Wales, and F. A. S. E.

(B) The author has taken the liberty of here adopting the word *linear*, from its ſtrict analogy to this mode of engraving, and with the approbation of ſome of the firſt profeſſors, both in painting and engraving.

Engraving

tinguiſhed by the terms, *linear expreſſion*, *imitation*, *diſpoſition*, and *harmony*; with a ſtrict inveſtigation of the firſt and moſt approved ſubjects, either in etching or engraving; and of their eſſential beauties, as far as they may tend to illuſtrate the ſubject.

As the great object of this mode of engraving is, to adopt thoſe lines the moſt expreſſive of the form and character of whatever happens to be repreſented, by maturely inveſtigating not only the action but the cauſe and correſpondent effects of the original picture; in order that the artiſt may avail himſelf of all that is moſt beautiful in his tranſlation, and efficient in the aggregate, either with reſpect to the expreſſion, ſpirit, or ſentiment.

On linear expreſſion and diſpoſition.

When hiſtorical ſubjects conſiſt of ſeveral figures, where there is generally a variety of draperies, ſome of them appearing thick and cumberſome, others more thin and flexible, ſitting cloſe and elegant on the limbs, being compoſed of a finer texture, or thread; the coarſer ſtuffs are conſequently more effectually repreſented by a bolder line, as the thinner ſort, by the application of a fine line, gives a more lively repreſentation; a diſcrimination which has been obſerved of late, by the moſt approved modern artiſts in linear engraving. Obſervations of this deſcription, when treated in a liberal manner, not only ſuperadd a degree of truth, but even render the ſubjects ſweeter to the eye of fancy. In the early ſtages of the art, ſome excellent artiſts have been led into particular and limited ſyſtems. In the works of ſuch as have affected to deſcribe every ſubject in the ſame line indiſcriminately, even the arms of the moſt delicate women are often engraven as if perfectly poliſhed, by approaching to a metallic appearance, a mode not uncommon among the ſecond or third claſs of artiſts about the beginning of the laſt century; by which manner, all that ſoftneſs and delicacy was neglected, which is ſo happily effected in the linear productions of Bartolozzi, Morgan, Sharp, Heath and others, at preſent of the firſt maſters in Europe. Thoſe who are acquainted with the works of the ingenious Chaffard, muſt with pleaſure have perceived in his foliage, how even the texture of flowers are imitated from the delicate line-like fibres of which they are compoſed, iſſuing from the ſtem, and ſpreading their ſilken beauties to the ſun: and in this claſs of imitation, the clear tranſparency of glaſs, the rough texture of woollen, the thinneſs of lawn, the flickerings of ſatin, or the lightnings of ſteel, as well as the rude rock, the lucid lake, or the flaſhing of the torrent, are all admirably adapted to linear effect by the almoſt infinite diverſity in their conſtruction, and general conſtituent principles, ſtrictly obſerving on what laws the beauty of lines conſiſts, by ever keeping in view the due balance of taſte, and a noble ſimplicity of ſtyle throughout. It is the buſineſs of the ſkilful artiſt to overpower and ſubdue the difficulties in his profeſſion; for no excellence in art is of cheap or vulgar acquiſition. Let it be remembered that with forming ſteel, even the enchanting graces of the Venus de Medicis were hewn from a rock, and the almoſt breathing Apollo, from a block of Parian ſtone.

An elegant Engliſh poet, in a critical eſſay on poetry, obſerves, that the ſound ſhould ſeem an echo to the ſenſe; ſo ſhould the lines in a fine print ſeem to harmonize with the ſubject, by flowing with the external caſt of the features, and the predominant paſſion expreſſed in the original picture; for the ſame character and diſpoſition of the lines that ſuit the action of the muſcles in one paſſion, will be found to appear more vacant and leſs expreſſive when applied to others, however graceful they may appear. Engraving

As this is a point of view to which the art has never yet been fully extended, perhaps it may meet with ſome degree of attention, as it will be found of utility in forming a principle reſpecting diſpoſition, more particularly in hiſtorical ſubjects, where the paſſions are required to be nicely expreſſed: and although it may admit of ſome ſlight exceptions, it is a principle that will in general be found to be true.

For example, let it be ſuppoſed, that the paſſion of the figure repreſented, is that of joy; the lines ſhould ſeem to expand and ſwell, with every acting muſcle, in the moſt delicate manner poſſible.

But, on the contrary, if the ſubject diſplays deep ſorrow, they ſhould rather incline downward, partaking ſomewhat of the half ſtraight, ſeeming to act apparently in perfect uniſon and conformity with the features of the face, with all due ſubordination to the general effect of light and ſhadow.

Various obſervations may be made in this manner on the principal paſſions expreſſed in the human countenance, which are but few comparatively, even from the ſlighteſt movement to the boldeſt action. We often find, on examining the works of thoſe maſters who are not ſo conſpicuous for great clearneſs of execution, that they have been occupied by the diſpoſition and energy of the lines, as in the magnificent and maſterly prints of the battles of Alexander, from the pictures of Carlo le Brun, engraved by Gerrard Audran; where the executive department is no leſs conſpicuous from the burin of the Chevalier Edelinck in the fine print of the tent of Darius: whilſt Audran diſplays the true ſpirit of art, but rarely avails himſelf of much of the mechanical principles. The field, and tumult of battle, ſeemed admirably calculated to call forth his rapid powers, particularly in works of magnitude.

The leſs active ſcenery of the tent of Darius, was equally appropriated to the ſplendid talents of Edelinck, as he ſeems to have been better qualified to diſplay ſubjects of that nature in general. This is ſufficiently obvious from the beautiful and intereſting groupe of the queen mother, and her illuſtrious family, kneeling at the feet of the conqueror; his impreſſive print of the magdalene, or his moſt admirable portraits of the dignified clergy, diſtinguiſhed authors, and eminent artiſts. Theſe, in point of engraving, are no leſs remarkable for taſte in the execution, than for truth and nature in expreſſion.

In one of the battles of Alexander, the groupe where Porus is wounded and ſupported by the ſoldiers, the rough diſcrimination of line finely accords with that bold deportment of character in the grim viſage of that gigantic prince, whilſt a more delicate line marks the youthful countenance of Alexander; a diſcrimination which is totally loſt in the large Dutch copy by de Vos.

In the ſame print, the figures of Alexander and Clytus, are finely relieved from the diſtant ſcenery by the varied deſcription of engraving on their armour, drapery, and horſes. The latter are managed with ſuch freedom and ſpirit, that it is difficult to ſay whether the horſes or figures ſeem the moſt with maſterly execution; particularly

Engraving. particularly the white war-horſe on the right extremity of the print (c).

Had Audran ſuperadded a ſtill greater portion of the delicacy and clearneſs of handling ſo conſpicuous in Edelinck and other eminent artiſts ſince that period, it would undoubtedly have given an additional beauty to his other tranſcendant acquiſitions; namely the vaſt ſpirit of his lines, and power in drawing.

But it is ſeldom the lot of an individual to combine every excellence. Arts too have their infancy: for they generally require the labour of ages to bring them to maturity and perfection, and it yet remained to unite and ameliorate the poliſh of Edelinck, to the ſpirited ſtyle of Audran. Without prejudice or partiality, a conſiderable degree of this excellence will be found in the beſt works of Britiſh art, as we ſhall hereafter exemplify.

Another fine ſpecimen of lineal engraving, and of a different claſs, is the celebrated ſtorm by Balechow, from a picture of the famous Vernet. In this print he has tranſmitted with the graver a certain fluidity and action in repreſenting the liquid element, to which the art had never before attained. To a grandeur of ſtyle in the bold ſwelling of the waves, he has ſuperadded the utmoſt tranſparency of line; at the ſame time, having attended to all that light reſtleſs ſpray which ſeems ſporting to the gales as they roll along. In a fanciful mood, one might almoſt imagine they heard the motion of the water: ſo finely did this diſcriminating artiſt tranſlate, (if I may be allowed the expreſſion) this admirable picture.

When we conſider the period in which this diſtinguiſhed work was engraved, and that little or nothing had been previouſly done in that department of a ſimilar excellence; it is hoped it will be a ſufficient apology for the degree of admiration here expreſſed: for, as Lord Verulam truly obſerves, "we are too prone to paſs thoſe ladders by which the arts are reared, and generally reflect all the merit to the laſt new performer." We have already obſerved, they are ſeldom reared with rapidity, and oftentimes that which is conſidered an invention, is only a long ſucceſſion of trials and experiments, which have gradually followed each other, and ought rather to be conſidered as a ſeries of human mind than the knowledge of an individual, being the works of ages. In any point of view, the preſent ſubject will ever be conſidered as a high improvement and an elegant acquiſition in the annals of the linear art. But in hiſtorical ſubjects this artiſt is by no means equal in point of taſte or diſcrimination. His print of St Genevive undoubtedly ranks high in the firſt claſſes of engraving. Had his taſte in other reſpects been equal to his powerful clearneſs of execution, it would have been almoſt unparalleled; but it betrays a want of that eſſential, even in his mode of thinking. Patience and labour are everywhere too prevalent. It remained for Woollet to excel both in figures and in landſkip.

In the various ſtyles and modifications of this expreſſive art, from the NEAT to the FEEBLE, and from the BOLD to the EXTRAVAGANT, *Taſte* ſtands ſole arbitreſs: in brief, it is ſhe who diſtributes variety with ſpirit, and conceals the appearance of intricacy and labour; who, by a due modification of line, unites clearneſs to ſoftneſs, arreſting Engraving. the hand of the ſkilful artiſt, from every effort inconſiſtent with her powers; producing at once to the mind all that agreeable finiſhed combination or harmony which ever accompanies and conſtitutes the perfection of true art.

In the execution of ſubjects of imagination, there is a perpetual ſcope for calling forth the fancy of the engraver, as the various combinations of lines are inexhauſtible, uncommon effects, ſuch as aerial ſpirits, or celeſtial beings blended with the light, or ghoſts commingled with the gloom, or fairy elves by moonlight, who trip the ſands, and yet no footing ſeen; or woodnymphs, laving their taper limbs in the limpid element. Such ſubjects, in point of ſtyle, depend entirely upon the beauty, lightneſs, and tranſparency of execution; for thoſe that are merely ornamental or groteſque, demand a ſtyle of a different caſt from that of the ſerious or hiſtorical, as they require a leſs degree of truth even from the burin. In theſe caſes the ſtyle may be as capricious as the ſubjects. Thoſe of Raphael, in the Vatican, diſplay an uncommon degree of taſte, and particularly in the elegant flow of line with which they are compoſed.

In all works of taſte and genius, thoſe which may appear the moſt ſimple at a tranſient glance, will be often found to contain the moſt art on a more mature inveſtigation. The firſt impreſſion may ſtrike the fancy, but the ſecond generally calls up the diſcriminating powers of the judgment.

Arts generally riſe in our eſteem according to the degree of exertion of the mental powers which they require; and, as lines are capable of various ſtyles, thoſe which are moſt congenial to the ſubject repreſented ought to be adhered to in preference to every other conſideration. Teniers, and Gerrard Douw, demand all the fidelity and delicacy of the burin in deſcribing the various draperies and individualities which belong to that claſs of painting; but, in proportion as the contour is compoſed of fewer parts, and the forms more full and elegant, the beautiful flowing qualities of the graver is increaſed, and its lines glide more graceſully over the figures, as may be found in the works of Strange and others from Guido and Corregio. This diſtinction will not appear ſo obvious on a ſuperficial view of the art. But, on a due inveſtigation, it will be found, that not only a different modification of lines is neceſſary to the various claſſes of painting, but that even a different deſcription of ſtyle is requiſite to characterize ſome of the maſters in each particular claſs, from the ſublime and elevated figures of a Raphael and Michael Angelo, to the ſimple cottagers of Adrian Oſtade.

When we take a more comprehenſive view of the art, we often find, that the ſtyles which are adopted in the different countries in Europe by the artiſts where the art has in any degree been cultivated, are generally regulated by the modes of painting, drawing, and even the colouring reſpectively in each, whether hiſtorical, portrait, or landſcape, and is proportionably appretiated according to the effective beauty and elegance of the execution.

(c) Whenever Mr Bartolozzi happened to ſpeak of thoſe prints to me, he always expreſſed himſelf with a great degree of enthuſiaſm, thinking himſelf extremely fortunate in having works of ſuch excellence in his poſſeſſion.

Engraving. It is not improbable that the clear mode, which at preſent conſtitutes the modern German ſchool, is a refinement on the ſimple ſtyle of Cornelius Bloemart.

In Italy, Jachimo Frey, that aſtoniſhing Swiſs, from his maſterly expertneſs in drawing, and a rapid uſe of the etching ſteel and the nitre, almoſt produced an entire revolution in the art. The unprecedented richneſs and eaſe, the freedom and energy of his ſtyle, and the number and magnitude of his works, attracted all Italy, and tended greatly to improve the Roman ſchool. About the year 1672, we find him working jointly with the nervous Dorigny Frezza, and Vanauden Aird. From this ſource we can perceive the ſtyle of Wagner, of Cars in France, and various maſters now living; namely, Franciſco Bartolozzi, Giovanni Volpato, Dominicus Cunigo, and ſome of the early works of the excellent Raphael Morghen.

In many inſtances Frey indicates, that if he had conſidered it of ſufficient conſequence to the art, he could have engraved with more clearneſs, particularly by his curious copy from the celebrated print by Edelinck, of the Madona and Child, with St John and Angels, from Raphael; and although but an imitation of another ſtyle, tends to ſhew the verſatility of his talents), when the judgment is for a while ſuſpended to know which is the original. We find a performance of Frey's, entitled *La Charité Humaine*, dated 1723; a print was afterwards engraved from the ſame ſubject at Paris by Daulle, dated 1763, in which he has rather been too profuſe in the mere mechanical part of the art, and deſtitute of that ardour which a well engraved work ſhould not only inſpire but maintain.

It is not enough for lines to be only well diſpoſed, but alſo full of expreſſion: neither is it enough for a line to be only clearly cut, but it muſt alſo be free; for in a certain free light ſpirited lines convey an idea of animation, and are ſuited to ſubjects of that deſcription, while the long ſweeping and bold lines are better adapted to the ſolemn and majeſtic productions of the pencil.

A fine print, like a miniature picture, ought to be viewed near the eye: as in itſelf, from the nature of the art, will be found a due ſubordination of effect, ever receding from the bold and articulated lines in the fore ground to thoſe which are more evaneſcent and remote.

The graceful birch, the mountain aſh, and the oak, have each their peculiar bark and texture; and theſe, when freely indicated, ſtamp their mark and character moſt completely to the eye. Much of this, as has been formerly mentioned, depends upon, and is regulated by, the peculiar ſtyle of the picture and the ſkill of the engraver.

As lines ſeem to partake of motion, in proportion as they deviate in gentle bendings from the ſtraight and preciſe; even ſo alſo, in the motion of water ſeemingly increaſed, whether they undulate with the ſimpleſt wave, or ſwell with the fierce and tempeſt-curled ſurge. This character is ſufficiently illuſtrated in the works of Balechow and Woollet.

In the late Mr Brown's large print of St John preaching in the wilderneſs, no engraver has ever more fully diſplayed the true ſpirit of Salvator Roſa, particularly in the original mode of treating the rocks, and the bold ſtyle of the ſurrounding ſcenery; in ſhort, in the aggregate it is a chef d'œuvre unparalleled in any country. This is freely acknowledged, not only by every man of taſte, but by the firſt landſcape engravers. (D). Engraving.

But Brown was perhaps leſs happy in the companion to the above, from the celebrated *Both*, by adapting a ſimilar mode to that finiſhed and delicate painter. For the ſtyle ſhould ever vary with the ſubject.

"Whate'er Lorrain light touched with ſoftening hue,
Or ſavage Roſa daſh'd, or learned Pouſſin drew."—
THOMSON'S *Caſtle of Indolence*.

His admirable etchings of the cottager and its companion, and the Celadon and Amelia, are fine ſpecimens of his diſcriminating powers, and characterized with ſo near an approach to truth, that we cannot help exclaiming with the poet,

"He ſees no other, nature's ſelf who ſees."

The engraving of the above ſubjects was finiſhed by the matchleſs Woollet, with the ſame happy taſte. And it muſt be acknowledged that it is but ſeldom that we ſee ſo many excellencies united; for it is equally rare to ſee the fineſt engraving united to the fineſt drawing, as to find it in painting combined with the choiceſt colouring: yet each have their decided faſcinations in the gallery, the cabinet, or the portfolio.

Woollet, whoſe works abound with nerve and intelligence in point of character, his ſtyle of landſcape is delightfully deſcriptive; whether rocks, water, trees, or ſky; as the Niobe, the Ceyx, and Alcyone, and other maſter-pieces from the great Wilſon evince. In the winter ſcene from Smith of Chicheſter, he has admirably contrived to convey the effect of the drifted ſnow, by delicate dotting, and with no leſs preciſion he has deſcribed the tranſparent ice with clear lines. Of trees, he was the firſt that ever faithfully characterized the graceful larch; as may be ſeen in his views of the noblemen's ſeats. In the print of the fiſhery, he is indebted to the maſterly etching of John Brown, particularly the ſhipping, in which there is perhaps no ſubject more artieulate and perſpicuous. The engraving of this ſubject is finiſhed by himſelf. In his figures he was the founder of a ſtyle, moſt happily adapted for modern dreſſes, and hiſtorical portraiture; a ſtyle in which he moved with unrivalled reputation. His print of the death of General Wolfe, painted by Mr Weſt, is an admirable example, and does honour to the Britiſh nation. It occupied him no leſs than four years. The print of the battle at La Hogue is another fine ſpecimen of his knowledge of linear diſcrimination. In ſhort, when we conſider the talents of this artiſt, it is difficult to decide whether he moſt excelled in modern hiſtory or landſcape. The art has to regret that he, who was ſo eminently qualified to adorn any line of the profeſſion, has left no works in ancient hiſtory. We have little doubt from his knowledge, and a real love of the art, he would have left a ſufficient monument in that department alſo, for the pleaſure and contemplation of the

(D) Were I at liberty to mention eminent living artiſts, I would have been induced here among others, to have mentioned the ſubject of the Tempeſt in the Twelfth Night, from the late ingenious Wright of Derby, engraved by Mr Middleman, in the Meſſrs Boydell's large edition of the immortal bard of Avon.

Engraving. the real connoiſſeur and of poſterity. Engraving in this country ſuſtained a heavy loſs when he died; and if the death of ſo excellent an artiſt may be conſidered as a public loſs, it is certainly the more felt with reſpect to Woollet, who died while he was yet improving in that excellence (E).

Chattelaine has been termed a mannerift in his drawings, but he muſt certainly be allowed to be an excellent one: his etchings are variety itſelf. Perhaps in the department of etching no artiſt has ſo happily tranſlated the pictures of Claude de Lorraine as Francis Vivares; that is, with reſpect to aerial perſpective, the peculiar characteriſtic of Claude. But his merits are not confined to this maſter alone; for he followed Ruyſdale, Berghem, Gainſborough, and Cuype, with great ſucceſs. He has ſuch a free delivery of ſtyle, that almoſt every one who examines his works is irreſiſtibly impreſſed with an idea of performing the very ſame. Few artiſts, it has been mentioned, have excelled in the etching department. We cannot, however, omit the name of Peranezzi; who, to originality of ſtyle, which is apparently ſpontaneous, joins a certain grandeur which had never been ſurpaſſed. He has tranſmitted to poſterity ſo ſpirited a repreſentation of the Greek and Roman edifices and ruins, that travellers have often confeſſed that they have raiſed their ideas beyond the magnitude of the ſuperſtructures themſelves. It is certain that in works of this ſtupendous nature, a degree of ruggedneſs in the execution correſponds with the ſublimity of the ſubjects; and thus produces a ſtill greater power over the mind, than if they had been more poliſhed. Some have cenſured his figures, and not without cauſe. This defect has been ingeniouſly palliated by an excellent artiſt, Mr Bartolozzi. "For (ſaid he) if the purchaſers of the works of Peranezzi, get ſo much for their money in the building way, the figures may be ſuppoſed to be given for nothing." Doubtleſs thoſe vaſt piles of periſhing grandeur, were never more judiciouſly preſented to the eye, than by this aſtoniſhing artiſt, or better calculated to affect the mind by calling forth its moſt ſublime ideas.

We have another ſtriking inſtance of ſpirited etching in a different purſuit of the art, in the works of Ridinger, a name which brings along with it all the ſavage ſcenery of nature.

"Aſſembling wolves in raging troops deſcend.
——— They faſten on the ſteed and pierce his mighty heart."

THOMSON'S *Winter*.

For we ſhall ever find ſome peculiar beauty to admire, even in the ſlighteſt productions of genius, as well as in the moſt perfect productions of the burin.

There are few artiſts who do not regret, that etching was unknown to Bolſwert, who has done ſo much without its aid; from which we may eaſily ſuppoſe how much more he could have effected with this charming acquiſition. For the truth of this remark we may appeal to his landſcapes from Rubens, his animated portraits from Vandyke, and his productions from the Flemiſh ſchool of hiſtory, particularly his large print of the taking down from the croſs from Rubens. Engraving.

There is a fine inſtance of linear effect in a print of a Flemiſh converſation piece by Wille. One of the figures is drinking out of a glaſs, and the artiſt has moſt deceptively deſcribed the texture of the drinker's face through the glaſs. In the ſame print, a female figure ſhews great ſkill in this way, even the floor is characterized by lines; and the whole ſtrongly marks the moſt proper mode of treating ſubjects of a mere local nature. The beautiful print of the *Petit Phyſicien*, is alſo an admirable imitation, particularly the little pellucid globule which has juſt mounted from the ſhell. When lines are engraved in a ſquare acute method of croſſing, they generally convey the idea of hardneſs to the ſubject repreſented. The ſcientific Picart ſeems to have been ſo much aware of this, that in a print of his engraving of a large marble groupe of horſes, from the animated chiſſel of Perriere, he adopted this ſtyle in order to heighten the imitation.

Maſon's print of Marſhal Harcourt, is one of the many fine efforts of portrait engraving; and although it was executed at an early period of the art, it abounds with no ſmall degree of taſte. The celebrated print (called the table-cloth) from Titian, of the Laſt Supper, alſo contains a conſiderable degree of linear diſcrimination, although he ſometimes carries it to affectation. He is rather ſingular in his mode of engraving hair. Yet the portraits of Marſhal Harcourt and Briſaſiere the ſecretary may be deemed exceptions.

Wille, by the magic of his tooling, is too apt at times to give his works indiſcriminately the appearance of bronze; and we frequently find the ſame in the figures of Balechow: but it ſeems to have been reſerved for Strange to give the ſoftneſs of carnation to copper; and to Woollet, to give force and clearneſs with diſcriminating taſte. Bartolozzi in his lines elegance delicacy and drawing; while the works of Audran teem with boldneſs and ſimplicity. In the prints of Sir Robert Strange, the greateſt excellence is perhaps his rich and harmonious tones, as well as the whole effect, which is ſupported by an expreſſive ſtyle; which he ſeems in a great meaſure to have invented for his moſt favourite painters, Corregio, Titian, Guido, and Guerchino. The ſoftneſs, the guſto, and the flowing draperies in the works of theſe maſters, were his delight. His ſleeping Cupid from Guido, and the prints of the Venus and Danae from Titian, will ever be eſteemed as *chef d'œuvres* in the linear art.

Having thus attempted to fulfil our original intention of diſcriminating the moſt expreſſive combinations of lines, and of analyzing and illuſtrating their various powers and effects in engraving, we ſhall now conclude theſe obſervations; and if, from the nature of the ſubject, and from the limits of the ſketch, we have failed in marking every brilliant ſtar in the galaxy of the art; it muſt at leaſt be acknowledged, that we have not omitted ſome of thoſe of the firſt magnitude.

Engraving upon Glaſs. See *Glass, Engraving on.*

Engraving

(E) Although we are now contemplating linear engraving, it is but proper here to obſerve, that chalk engraving, mezzotinto, and aquatinta, have alſo made ample improvements in this country, in their various ſtyles of excellence.

Engraving. *Engraving on Precious Stones*, is the repreſenting of figures, or devices, in relievo, or indented, on divers kinds of hard poliſhed ſtones.

The art of engraving on precious ſtones is one of thoſe wherein the ancients excelled; there being divers antique agates, cornelians, and onyxes, which ſurpaſs any thing of that kind the moderns have produced. Pyrgoteles among the Greeks, and Dioſcorides under the firſt emperors of Rome, are the moſt eminent engravers we read of; the former was ſo eſteemed by Alexander, that he forbade any body elſe to engrave his head; and Auguſtus's head, engraven by the latter, was deemed ſo beautiful, that the ſucceeding emperors choſe it for their ſeal.

All the polite arts having been buried under the ruins of the Roman empire, the art of engraving on ſtones met with the ſame fate. It was retrieved in Italy at the beginning of the 15th century, when one John of Florence, and after him Dominic of Milan, performed works of this kind no way to be deſpiſed. From that time, ſuch ſculptures became common enough in Europe, and particularly in Germany, whence great numbers were ſent into other countries: but they came ſhort of the beauty of thoſe of the ancients, eſpecially thoſe on precious ſtones; for, as to thoſe on cryſtal, the Germans, and, after their example, the French, &c. have ſucceeded well enough.

In this branch of engraving, they make uſe either of the diamond or of emery.

The diamond, which is the hardeſt of all ſtones, is only cut by itſelf, or with its own matter. The firſt thing to be done in this branch of engraving is, to cement two rough diamonds to the ends of two ſticks big enough to hold them ſteady in the hand, and to rub or grind them againſt each other till they be brought to the form deſired. The duſt or powder that is rubbed off ſerves afterwards to poliſh them, which is performed with a kind of mill that turns a wheel of ſoft iron. The diamond is fixed in a braſs diſh; and, thus applied to the wheel, is covered with diamond duſt, mixed up with oil of olives; and when the diamond is to be cut facet-wiſe, they apply firſt one face, then another, to the wheel. Rubies, ſapphires, and topazes, are cut and formed the ſame way on a copper wheel, and poliſhed with tripoli diluted in water. As to agates, amethyſts, emeralds, hyacinths, granites, rubies, and others of the ſofter ſtones, they are cut on a leaden wheel, moiſtened with emery and water, and poliſhed with tripoli on a pewter wheel. Lapis-lazuli, opal, &c. are poliſhed on a wooden wheel. To faſhion and engrave vaſes of agate, cryſtal, lapis-lazuli, or the like, they make uſe of a kind of lathe, like that uſed by pewterers, to hold the veſſels, which are to be wrought with proper tools: that of the engraver generally holds the tools, which are turned by a wheel; and the veſſel is held to them to be cut and engraved, either in relievo or otherwiſe; the tools being moiſtened from time to time with diamond duſt and oil, or at leaſt emery and water. To engrave figures or devices on any of theſe ſtones, when poliſhed, ſuch as medals, ſeals, &c. they uſe a little iron wheel, the ends of whoſe axis are received within two pieces of iron, placed upright, as in the turner's lathe; and to be brought cloſer, or ſet further apart, at pleaſure: at one end of the axis are fitted the proper tools, being kept tight by a ſcrew. Laſtly, The wheel is turned by the foot, and the ſtone applied by the hand to the tool, and is ſhifted and conducted as occaſion requires. Engraving || Enharmonic.

The tools are generally of iron, and ſometimes of braſs; their form is various, but it generally bears ſome reſemblance to chiſels, gouges, &c. Some have ſmall round heads, like buttons, others like ferrels, to take the pieces out, and others flat, &c. When the ſtone has been engraven, it is poliſhed on wheels of hair-bruſhes and tripoli.

Engraving on Steel is chiefly employed in cutting ſeals, punches, matrices, and dyes, proper for ſtriking coins, medals, and counters. The method of engraving with the inſtruments, &c. is the ſame for coins as for medals and counters: All the difference conſiſts in their greater or leſs relievo; the relievo of coins being much leſs conſiderable than that of medals, and that of counters ſtill leſs than that of coins.

Engravers in ſteel commonly begin with punches, which are in relievo, and ſerve for making the creux or cavities of the matrices and dyes: though ſometimes they begin with the creux or hollowneſs; but then it is only when the intended work is to be cut very ſhallow. The firſt thing done, is that of deſigning the figures; the next is the moulding them in wax, of the ſize and depth they are to lie, and from this wax the punch is engraven. When the punch is finiſhed, they give it a very high temper, that it may the better bear the blows of the hammer with which it is ſtruck to give the impreſſion to the matrice.

The ſteel is made hot to ſoften it, that it may the more readily take the impreſſion of the punch; and after ſtriking the punch on it in this ſtate, they proceed to touch up or finiſh the ſtrokes and lines, where by reaſon of their fineneſs or the too great relievo they are any thing defective, with ſteel gravers of different kinds; chiſels, flatters, &c. being the principal inſtruments uſed in graving on ſteel.

The figure being thus finiſhed, they proceed to engrave the reſt of the medal, as the mouldings of the border, the engrailed ring, letters, &c. with little ſteel punches, well tempered, and very ſharp.

ENGUICHE', in *Heraldry*, is ſaid of the great mouth of a hunting horn, when its rim is of a different colour from that of the horn itſelf.

ENHARMONIC, in *Muſic*. The Greeks had three different ſpecies of muſic; the *diatonic*, the *chromatic*, and the *enharmonic*. This laſt was eſteemed by much the moſt agreeable and powerful of the three; but the difficulty of its execution rendered its duration ſhort, and latter artiſts were upbraided for having ſacrificed it to their indolence. It proceeded upon leſſer intervals than either the diatonic or chromatic; and as the chromatic ſemitone is ſtill leſs than the diatonic, the *enharmonic* intervals muſt have conſiſted of that ſemitone divided into parts more minute. In Rouſſeau's Muſical Dictionary (at the word *Enharmonique*), the reader may ſee how that interval was found in the tetrachords of the ancients. It is by no means eaſy for modern ears, inured to intervals ſo widely different, to imagine how a piece of muſic, whoſe tranſitions were formed either chiefly or ſolely upon ſuch minute diviſions, could have ſuch wonderful effects; yet the melody of ſpeech, which riſes or falls by intervals ſtill

more

Enhydrus || Ennius.

more minute than the enharmonic, when properly modulated and applied with taſte, has an aſtoniſhing power over the ſoul. As to the modern *enharmonic* ſyſtem, we may likewiſe refer the reader to the ſame work for an account of its nature and uſe; though he will find it accurately and clearly explained by D'Alembert in the Treatiſe of Music given in the preſent work, (art. 144. 145. 146.)

ENHYDRUS, in *Natural Hiſtory*, a genus of ſiderochita or cruſtated ferruginous bodies, formed in large and in great part empty caſes, incloſing a ſmall quantity of an aqueous fluid.

Of this genus there are only two ſpecies: 1. The thick-ſhelled enhydrus, with black, reddiſh-brown, and yellow cruſts. 2. The thinner-ſhelled kind, with yelloviſh-brown and purple cruſts; neither of which ferments with aquafortis or gives fire with ſteel.

ENIGMA. See ÆNIGMA.

ENIXUM, among chemiſts, a kind of natural ſalt, generated of an acid and an alkali.

The ſal enixum of Paracelſus, is the caput mortuum of ſpirits of nitre with oil of vitriol, or what remains in the retort after the diſtillation of this ſpirit; being of a white colour, and pleaſing acid taſte.

ENMANCHE', in *Heraldry*, is when lines are drawn from the centre of the upper edge of the chief to the ſides, to about half the breadth of the chief; ſignifying ſleeved, or reſembling a ſleeve, from the French *manche*.

ENNA, in *Ancient Geography*, a town of Sicily, ſituated on an eminence to the ſouth of the Chryſas; called the *centre of Sicily*. It was famous for a ſacred grove, in which the rape of Proſerpine happened; for a temple of Ceres, thence ſurnamed *Ennæa*, and *Ennenſis*; and for fine ſprings, whence the name (Bochart.)

ENNEAGON, in *Geometry*, a polygon with nine ſides. See POLYGON.

ENNEAHEDRIA, in *Natural Hiſtory*, a genus of columnar, cryſtalliform, and double-pointed ſpars, compoſed of a trigonal column, terminated at each end by a trigonal pyramid.

Of this genus there are ſeveral ſpecies, diſtinguiſhed by the length or ſhortneſs of the column and pyramids, none of which give fire with ſteel, but all of them ferment with aquafortis.

ENNEANDRIA, in *Botany*, (from ἐννέα, *nine*, and ἀνὴρ, a *man* or *huſband*), the name of the ninth claſs in Linnæus's ſexual ſyſtem, conſiſting of plants which have hermaphrodite flowers, with nine ſtamina or male organs. See BOTANY *Index*.

ENNIUS, QUINTUS, an ancient Latin poet, born at Rudii, a town in Calabria. He came firſt to Rome when M. Porcius Cato was queſtor, whom he had inſtructed in the Greek language in Sardinia; and by his genius and behaviour he gained the eſteem of the moſt eminent perſons in the city. According to Horace, Ennius never applied himſelf to writing till he had drank freely of wine. Hence he contracted the gout, of which he died nine years B. C. He was interred in Scipio's ſepulchre; who had a great eſteem and friendſhip for him, and cauſed a ſtatue to be erected to him upon his monument. He endeavoured to introduce the treaſures of the Greek tongue among the Latins, and was the firſt among the Romans who made uſe of heroic verſes. He wrote the *Annals of Rome*; he tranſlated ſeveral tragedies from the Greek, and wrote others, beſide ſeveral comedies. We have only ſome fragments of his works, which were firſt collected by the two Stephens, and afterwards publiſhed at Naples, with a learned commentary, by Jerom Columna, in quarto, 1590; and reprinted at Amſterdam in 1707, in quarto, with additions by Heſſelius.

ENOCH, the ſon of Cain (Gen. iv. 17.), in honour of whom the firſt city taken notice of in Scripture was called *Enoch* by his father Cain, who built it. It was ſituated to the eaſt of the province of Eden.

ENOCH, the ſon of Jared and father of Methuſelah, was born in the year of the world 622. At the age of 65 he begat Methuſelah, and lived 300 years after, and had ſeveral ſons and daughter. Enoch walked with God; and after that he had lived in all 365 years, "he was not, for God took him." Some conſtrue theſe laſt words, as if they intimated that Enoch died a natural death, becauſe in reality he lived not near ſo long as the other patriarchs of thoſe times; as if God, to ſecure him from corruption, had been pleaſed to take him early out of this world. But the generality of the fathers and commentators aſſert that he died not, but was tranſlated out of the ſight of men, in like manner as Elijah was. The apoſtle Paul (Heb. xi. 5.) ſhows very clearly that Enoch was tranſlated, and did not ſee death.

The apoſtle Jude (ver. 14, 15.) cites a paſſage from the book of Enoch, which has very much exerciſed interpreters. The queſtion is, whether the apoſtle took this paſſage out of any particular book written by Enoch, which might be extant in the firſt ages of the church; whether he received it by tradition; or laſtly, by ſome particular revelation. It is thought probable, that he read it in the book we have been ſpeaking of, which, though apocryphal, might contain ſeveral truths that St Jude, who was favoured with a ſupernatural degree of underſtanding, might make uſe of to the edification of the faithful.

The ancients greatly eſteemed the prophecy of Enoch. Tertullian expreſſes his concern that it was not generally received in the world. That father, on the authority of this book, deduces the original of idolatry, aſtrology, and unlawful arts, from the revolted angels, who married with the daughters of men. St Auguſtin allows indeed that Enoch wrote ſomething divine, becauſe he is cited by St Jude; but he ſays it was not without reaſon that this book was not inſerted in the canon which was preſerved in the temple at Jeruſalem. This father ſufficiently inſinuates, that the authority of this book is doubtful, and that it cannot be proved that it was really written by Enoch. Indeed the account it gives of giants engendered by angels, and not by men, has manifeſtly the air of a fable, and the moſt judicious critics believe it ought not to be aſcribed to Enoch.

This apocryphal book lay a long time buried in darkneſs, till the learned Joſeph Scaliger recovered a part of it. Scaliger, Voſſius, and other learned men, attribute this work to one of thoſe Jews who lived between the time of the Babyloniſh captivity and that of Jeſus Chriſt. Others are of opinion, that it was written after the riſe and eſtabliſhment of Chriſtianity, by one

Enormous || Enſemble.

one of thoſe fanatics with whom the primitive church was filled, who made a ridiculous mixture of the Platonic philoſophy and the Chriſtian divinity.

The eaſtern people, who call Enoch by the name of *Edris*, believe that he received from God the gift of wiſdom and knowledge; and that God ſent him 30 volumes from heaven, filled with all the ſecrets of the moſt myſterious ſciences. The Rabbins maintain, that when Enoch was tranſlated to heaven, he was admitted into the number of the angels, and is the perſon generally known by the name of *Michael*.

ENORMOUS, ſomething exceſſive or monſtrous, eſpecially in bulk.—The word is formed of the privative *è*, and *norma*, "rule;" q. d. "void of, or contrary to, rule or meaſure;" *contra normam*. In the corrupt ages of Latinity they uſed *innormis* and *inormis*.

In the French juriſprudence, *leſio enormis*, "enormous damage," is that which exceeds half the value of the thing ſold.

ENOS, the ſon of Seth and father of Cainan, was born in the year of the world 235. Moſes tells us (Gen. iv. 26.), that then, "*men* began to call upon the name of the Lord;" or, as others tranſlate it, that "Enos began to call upon the name of the Lord;" that is to ſay, that he was the inventor of religious rites and ceremonies in the external worſhip which was paid to God. This worſhip was kept up and preſerved in Enos's family, while Cain's family was plunged in all manner of irregularities and impieties. Several Jews are of opinion, that idolatry was at firſt introduced into the world in the time of Enos. They tranſlate the Hebrew thus, "Then men began to profane the name of the Lord." Good men, to diſtinguiſh themſelves from the wicked, began to take upon them the quality of ſons or ſervants of God; for which reaſon, Moſes (Gen. vi. 1, 2.) ſays that *the ſons of God* (that is to ſay, the deſcendants of Enos, who had hitherto preſerved the true religion), ſeeing the daughters of men, that they were fair, took them wives of all which they choſe. Enos died at the age of 905 years, in the year of the world 1140.

ENS, among metaphyſicians, denotes entity, being, or exiſtence: this the ſchools call *ens reale*, and *ens poſitivum*; to diſtinguiſh it from their *ens rationis*, which is only an imaginary thing, or exiſts but in the imagination.

ENS, among chemiſts, imports the power, virtue, and efficacy, which certain ſubſtances exert upon our bodies.

ENS, in *Geography*, a city of Germany, ſituated at the confluence of the Danube and the river Ens, about 80 miles ſouth of Vienna. E. Long. 14. 20. N. Lat. 48. 16.

ENSATÆ, in *Botany*, (from *enſis*, "a ſword"); the name of the ſixth order in Linnæus's natural method, conſiſting of plants with ſword-ſhaped leaves. It contains the following genera, viz. Antholyza, Calliſia, Commelina, Crocus, Eriocaulon, Ferraria, Gladiolus, Iris, Ixia, Moræa, Pontæderia, Siſyrinchium. Tradeſcantia, Wachendorffa, Xyris. See BOTANY *Index*.

ENSEELED, in *Falconry*, is ſaid of a hawk that has a thread drawn through her upper eye-lid, and made faſt under her beak, to take away the ſight.

ENSEMBLE, a French term, ſometimes uſed in our language; literally ſignifying *together* or *one with another*:—being formed from the Latin *in* and *ſimul*.

Enſiformis || Ent.

In architecture, we ſay *the enſemble*, or *tout enſemble*, of a building; meaning the whole work, or compoſition, conſidered together, and not in parts; and ſometimes alſo, the relative proportion of the parts to the whole.—"All thoſe pieces of building make a fine *enſemble*."

To judge well of a work, a ſtatue, or other piece of ſculpture, one muſt firſt examine whether the *enſemble* be good. The *tout enſemble* of a painting, is that harmony which reſults from the diſtribution of the ſeveral objects or figures whereof it is compoſed.—"This picture is good, taking the parts ſeparately; but the *tout enſemble* is bad."

ENSIFORMIS CARTILAGO. See XIPHOIDES.

ENSIGN, in the military art, a banner or colours under which ſoldiers are ranged, according to the different companies or parties they belong to. See FLAG, COLOURS, STANDARD, &c.

The Turkiſh enſigns are horſes tails; thoſe of the Europeans are pieces of taffety, with divers figures, colours, arms, and devices thereon. Xenophon tells us, that the enſign borne by the Perſians was a golden eagle on a white flag; the Corinthians bore the winged horſe, or Pegaſus, in theirs; the Athenians, an owl; the Meſſenians, the Greek letter M; the Lacedæmonians the A. The Romans had a great diverſity of enſigns; the wolf, minotaur, horſe, boar, and at length the eagle, where they ſtopped: this was firſt aſſumed in the ſecond year of the conſulate of Marius *. A military enſign on a medal of a Roman colony denotes it a colony peopled with old ſoldiers.

* See *Eag.*

ENSIGN is alſo the officer that carries the colours, being the loweſt commiſſioned officer in a company of foot, ſubordinate to the captain and lieutenant. It is a very honourable and proper poſt for a young gentleman at his firſt coming into the army: he is to carry the colours both in aſſault, day of battle, &c. and ſhould not quit them but with his life: he is always to carry them himſelf on his left ſhoulder: only on a march he may have them carried by a ſoldier. If the enſign is killed, the captain is to carry the colours in his ſtead.

Naval ENSIGN, a large ſtandard or banner hoiſted on a long pole erected over the poop, and called the *enſign-ſtaff*.—The enſign is uſed to diſtinguiſh the ſhips of different nations from each other, as alſo to characterize the different ſquadrons of the navy. The Britiſh enſign in ſhips of war is known by a double croſs, viz. that of St George and St Andrew, formed upon a field which is either red, white, or blue.

ENSISHEIM, a town of France, in Upper Alſace. It is a pretty little place, well built, and conſiſts of about 200 houſes. E. Long. 7. 30. N. Lat. 47. 58.

ENT, SIR GEORGE, an eminent Engliſh phyſician, born at Sandwich in Kent in 1604. He was educated at Sidney college, Cambridge; and, afterwards travelling into foreign countries, received the degree of doctor of phyſic at Padua. After his return he obtained great practice, was made preſident of the college of phyſicians in London, and at length received the honour of knighthood from King Charles II. He was extremely intimate with Doctor Harvey; whom he

Entablature || Entomology.

he learnedly defended, in a piece entitled *Apologia pro Circulatione Sanguinis, contra Æmilium Pariſanum.* He alſo publiſhed, *Animadverſiones in Malachiæ Thruſtoni;* and ſome obſervations in the Philoſophical Tranſactions. Glanville, ſpeaking of his *Plus Ultra* of the modern improvements in anatomy, numbers Sir George Ent, Doctor Gliſſon, and Doctor Wallis, with the moſt celebrated diſcoverers in that ſcience. The two former were among the firſt members of the Royal Society. Sir George Ent died in October 1689.

ENTABLATURE, or ENTABLEMENT, in *Architecture*, is that part of an order of a column which is over the capital, and comprehends the architrave, frize, and corniche. See ARCHITECTURE, chap. i.

ENTABLER, in the manege, the fault of a horſe whoſe croupe goes before his ſhoulders in working upon volts; which may be prevented by taking hold of the right rein, keeping your right leg near, and removing your left leg as far from the horſe's ſhoulder as poſſible.

This is always accompanied with another fault called *aculer*. See ACULER.

ENTAIL, in *Law*, ſignifies *feetail*, or *fee entailed;* that is, abridged, curtailed, or limited, to certain conditions. See FEE and TAIL.

ENTE', in *Heraldry*, a method of marſhalling, more frequent abroad than with us, and ſignifying grafted or ingrafted.

We have indeed, one inſtance of enté in the fourth grand quarter of his majeſty's royal enſign, whoſe blazon is Brunſwick and Lunenburg impaled with ancient Saxony, *enté en pointe*, "grafted in point."

ENTEROCELE, in *Surgery*, a tumor formed by a prolapſion of the inteſtines through the rings of the abdomen and proceſſes of the peritonæum, into the ſcrotum. See SURGERY *Index*.

ENTHUSIASM, an ecſtaſy of the mind, whereby it is led to think and imagine things in a ſublime, ſurpriſing, yet probable manner. This is the enthuſiaſm felt in poetry, oratory, muſic, painting, ſculpture, &c.

ENTHUSIASM, in a religious ſenſe, implies a tranſport of the mind, whereby it fancies itſelf inſpired with ſome revelation, impulſe, &c. from heaven. Mr Locke gives the following deſcription of enthuſiaſm. "In all ages, men in whom melancholy has mixed with devotion, or whoſe conceit of themſelves has raiſed them into an opinion of a great familiarity with God, and a nearer admittance to his favour than is afforded to others, have often flattered themſelves with a perſuaſion of an immediate intercourſe with the Deity, and frequent communications from the Divine Spirit. Their minds being thus prepared, whatever groundleſs opinion comes to ſettle itſelf ſtrongly upon their fancies, is an illumination from the Spirit of God. And whatſoever odd action they find in themſelves a ſtrong inclination to do, that impulſe is concluded to be a call or direction from heaven, and muſt be obeyed. It is a commiſſion from above, and they cannot err in executing it. This I take to be properly enthuſiaſm, which, though ariſing from the conceit of a warm and overweening brain, works, when it once gets footing, more powerfully on the perſuaſions and actions of men, than either reaſon or revelation, or both together; men being moſt forwardly obedient to the impulſes they receive from themſelves." Devotion, when it does not lie under the check of reaſon, is apt to degenerate into enthuſiaſm. When the mind finds itſelf inflamed with devotion, it is apt to think that it is not of its own kindling, but blown up with ſomething divine within it. If the mind indulges this thought too far, and humours the growing paſſion, it at laſt flings itſelf into imaginary raptures and ecſtaſies; and when once it fancies itſelf under the influence of a divine impulſe, no wonder if it ſlights human ordinances, and refuſes to comply with the eſtabliſhed form of religion, as thinking itſelf directed by a much ſuperior guide.

Enthuſiaſt || Entomology.

ENTHUSIAST, a perſon poſſeſſed with enthuſiaſm. See the preceding article.

ENTHYMEME, in *Logic* and *Rhetoric*, an argument conſiſting only of two propoſitions, an antecedent, and a conſequent deduced from it. The word is Greek, ἐνθύμημα, formed of the verb ἐνθυμεῖσθαι, "to think, conceive," a compound of ἐν and θυμος, "mind."

The enthymeme is the moſt ſimple and elegant of all argumentations; being what a man, in arguing cloſely, commonly makes, without attending at all to the form. Thus, that verſe remaining of Ovid's tragedy, entitled *Medea*, contains an enthymeme; *Servare potui, perdere an poſſum rogas:* "I was able to ſave you; conſequently to have deſtroyed you." All the beauty would have been loſt, had all the propoſitions been expreſſed; the mind is diſpleaſed with a rehearſal of what is nowiſe neceſſary.

Sometimes, alſo, the two propoſitions of an enthymeme are both included in a ſingle propoſition, which Ariſtotle calls an *enthymematical ſentence*, and gives this inſtance thereof: *Mortal, do not bear an immortal hatred.* The whole enthymeme would be, *Thou art mortal; let not, therefore, thy hatred be immortal.*

ENTITY, the ſame with ENS.

ENTOMOLOGY.

ENTOMOLOGY, (from ἔντομος, "an inſect", and λογος, "a diſcourſe,") is that part of zoology which treats of inſects.

Many are diſpoſed to reckon the ſtudy of Entomology trifling. Hunters of butterflies, and catchers of graſhoppers, are laughed at by the vulgar, and even by thoſe who are more enlightened. The great numbers and diverſity of inſects, the beauty and configuration of ſome of them, and the ſingular inſtincts of others, cannot but attract notice, and excite aſtoniſhment in thoſe who are fond of contemplating the works of nature, rendering thus the ſtudy of Entomology, to them, a ſource of much pleaſure. A collection of the individuals which compoſe any of the more numerous genera, placed at the ſame time, before one capable of attending to the ſtriking ſimilarity of the whole, and tracing

the diſtinguiſhing peculiarities of each, cannot fail to create ſurpriſe. The great and almoſt phantaſtic variety of their forms, the nice adaptation of their parts to the ſituation in which each happens to be placed, muſt appear truly wonderful. In every department of nature, which comes within the reach of the human mind, a pleaſing and luxuriant variety is diſcernible. The ſame ſupreme Intelligence, which, by varying the poſition of the planetary orbs with reſpect to the ſun, and by other ſeemingly ſimple but beautiful contrivances, hath produced their different length of day and year, and alternation of ſeaſons, is manifeſt in the formation of the minuteſt inſect. Each has received that mechaniſm of body, thoſe peculiar inſtincts, and is made to undergo thoſe different changes, which fit it for its deſtined ſituation, and enable it to perform its proper functions. The utility of many inſects, ſuch as the bee, the crab, the ſilk-worm, the cochineal inſect, &c. renders them both intereſting and important; and a more intimate acquaintance with the claſs, may enable us to add to the number of thoſe that are uſeful to man, and to improvements in the management of thoſe already known. The havock many inſects make in the vegetable kingdom, the vexation, diſeaſes, and deſtruction they occaſion among animals, ſhould induce thoſe who are engaged in agriculture, and in the rearing and management of animals, to pay attention to Entomology; for the better they are acquainted with their enemies, the abler they muſt be to attack them with advantage.

Moſt inſects undergo three very diſtinct changes: which circumſtance, joined to the very great difference of appearance which is often met with in the male and female, and even in the neuters of ſome ſpecies, renders their number apparently greater than it really is, and adds conſiderably to the difficulty of reducing them to order.

Different naturaliſts have attempted to arrange them into families and genera, particularly the celebrated LINNÆUS, whoſe arrangement is followed here. He has formed them into ſeven families or orders, compoſing his Definition. ſixth claſs of animals, INSECTA. He defines an inſect, a ſmall animal, breathing through pores on its ſides, furniſhed with moveable *antennæ* and many feet, covered with either a hard cruſt, or a hairy ſkin. Before the diſtinguiſhing marks of the orders and genera can be underſtood, it will be neceſſary to enumerate and explain the terms he has given to the different parts, and the moſt remarkable of the epithets he has applied to them.

The body is divided into *Head*, *Trunk*, *Abdomen*, and *Extremities*.

Head, &c. I. CAPUT, the *Head*, which is diſtinguiſhable in moſt inſects, is furniſhed with *Eyes*, *Antennæ*, and moſt frequently with a *Mouth*.

The EYES, 2, 4, 6, or 8 in number, deſtitute of eye-lids, are either ſmall and ſimple; or large, compound and hemiſpherical; or polyedral. They are commonly immoveable. They are called *ſtipitati* when placed on a ſtalk.

The ANTENNÆ are two articulated moveable proceſſes, placed on the head.

They are either, 1. *Setaceæ*, ſetaceous, i. e. like a briſtle, when they taper gradually from their baſe, or inſertion into the head, to their point.

2. *Clavatæ*, clavated, i. e. club-ſhaped, when they grow gradually thicker from their baſe to their point.

3. *Filiformes*, filiform, i. e. thread-ſhaped, when they are of an equal thickneſs throughout the whole of their length.

4. *Moniliformes*, moniliform, i. e. of the form of a necklace, when they are of an equal thickneſs throughout, but formed of a ſeries of knobs, reſembling a ſtring of beads.

5. *Capitatæ*, capitate, i. e. with a head or knob, when they grow thicker towards the point, and terminate in a knob or head.

6. *Fiſſiles*, fiſſile, i. e. cleft, when they are capitate, and have the head or knob divided longitudinally into three or four parts or laminæ.

7. *Perfoliatæ*, perfoliated, when the head or knob is divided horizontally.

8. *Pectinatæ*, pectinated, i. e. reſembling a comb, when they have a longitudinal ſeries of hairs projecting from them, in form of a comb.

9. *Barbatæ*, barbed, when they have little projections or barbs placed on their ſides. They are either, 1. *Longiores*, longer than the body; 2. *Breviores* ſhorter than the body; or, 3. *Mediocres*, of the ſame length with the body.

The MOUTH, in moſt inſects, is placed in the under part of the head; ſometimes however, it is ſituated in the thorax, and in a few inſtances, is entirely wanting. It is furniſhed with, 1. *Palpæ*, or feelers; 2. *Roſtrum*, i. e. beak or ſnout; 3. *Labium*, or lip; 4. *Maxillæ*, or jaws, placed tranſverſely, and moving laterally; 5. *Dentes*, or teeth; 6. *Lingua*, or tongue; 7. *Palatum*, or palate.

Palpæ, feelers, which are 4 or 6 in number, are attached to the mouth, and have 2, 4, or 3 articulations.

The *Stemmata* are three prominent ſhining points on the top of the head.

II. TRUNCUS, the *Trunk*, to which the legs are Trunk. attached, is ſituated between the head and the abdomen. It is divided into, 1. the *Thorax*, or cheſt, which is the ſuperior part; 2. *Scutellum*, i. e. ſmall ſhield or eſcutcheon, which is the poſterior part; 3. the *Breaſt* and *Sternum*, which is the inferior part.

III. The ABDOMEN, that part which contains Abdomen. the ſtomach, inteſtines, and other viſcera, conſiſts of ſeveral annular ſegments. It is perforated on the ſides with *ſpiracula*, i. e. breathing-holes. The upper part of it is termed *Tergum*, or back; the inferior part *Venter*, or belly; the poſterior part *Anus*.

IV. ARTUS, the extremities, are, 1. the *Wings*; Extremities. 2. *Legs*; 3. *Tail*.

I. ALÆ, the wings, are two, or four. They are either,

1. *Planæ*, i. e. plain, ſuch as cannot be folded up by the inſect.

2. *Plicatiles*, or folding, ſuch as can be folded up by the inſect at pleaſure.

3. *Erectæ*, erect, ſuch as have their ſuperior ſurfaces brought into contact, and ſtand upright when the inſect is at reſt.

4. *Patentes*, ſpreading; ſuch as are extended horizontally.

5. *Incumbentes*, incumbent; ſuch as reſt on the upper part of the abdomen.

6. *Deflexæ*, bent down; ſuch as are partly incumbent,

bent, but have their exterior edge inclined towards the ſides of the abdomen.

7. *Reverſæ*, reverſed; ſuch as are incumbent, but inverted.

8. *Dentatæ*, ſuch as have their edges notched or ſerrated.

9. *Caudatæ*, ſuch as have proceſſes extended from their extremitres like a tail.

10. *Reticulatæ*, netted; when the veſſels of the wings put on the appearance of net-work.

11. *Pictæ*, painted; ſuch as are marked with coloured ſpots, bands, ſtreaks, lines or dots.

12. *Notatæ*, marked with ſpecks.

13. *Ornatæ*, adorned with little eyes, or circular ſpots, containing a ſpot of a different colour in their centre. The central ſpot is termed *pupil*; the exterior one is called *iris*. This may happen either in the primary or ſecondary wings, on their upper or under ſurfaces. The ſuperior wing is called *primary*, and the inferior *ſecondary*, to avoid confuſion, as they may be at times reverſed.

Elytra. The ELYTRA are hard ſhells, occupying the place of the upper wings. They are, for the moſt part moveable, and are either,

1. *Truncata*, truncated, when ſhorter than the abdomen, and terminated by a tranſverſe line.

2. *Spinoſa*, or prickly, when their ſurfaces are covered with ſharp points or prickles.

3. *Serrata*, ſerrated, when their edges are notched.

4. *Scabra*, rough, when their ſurface reſembles a file.

5. *Striata*, ſtriated, when marked with ſlender longitudinal furrows.

6. *Porcata*, ridged, when marked with elevated ridges.

7. *Sulcata*, furrowed.

8. *Punctata*, marked with dots.

9. *Faſtigiata*, when formed like the roof of a houſe.

Hemelytra. The HEMELYTRA, as it were half-elytra, partaking partly of the nature of cruſtaceous ſhells, and membranaceous wings; being formed of an intermediate ſubſtance.

Halteres. HALTERES, or poiſers, are ſmall orbicular bodies placed on ſtalks, ſituated under the wings of infects, of the order *Diptera*.

II. PEDES, the *Legs*. They are divided into, 1. *Femur*, or thigh, that part which is joined to the trunk; 2. *Tibia*, or ſhank; 3. *Tarſus*, or foot; 4. *Ungues*, hooks or nails: 5. *Manus*, (chela), hands or claws, ſimple, with a moveable thumb, as in the crab.

The hind-legs are termed, 1. *Curſorii*, formed for running; 2. *Saltatorii*, formed for leaping; 3. *Natatorii*, formed for ſwimming.

III. CAUDA, the *Tail*, which terminates the abdomen, is, 1. *Solitaria*, i. e. ſingle. 2. *Bicornis*, i. e. two-horned or double. 3. *Simplex*, ſimple, i. e. unarmed. 4. *Armata*, i. e. furniſhed, 1. with *Forceps* or *Pincers*; 2. with *Furca*, a fork; 3. with one or more *Setæ* or briſtles; 4. with an *Aculeus*, or ſting, either ſmooth or barbed. A ſting is a weapon, frequently hollow, with which ſome infects are furniſhed, through which they diſcharge a poiſon into the wound they inflict.

Sexes The SEXES of infects are commonly two, *male* and *female*. *Neuters* are to be met with among thoſe infects which live in ſwarms, ſuch as ants, bees, &c.

Moſt infects undergo three changes. An infect is at firſt hatched from a very ſmall egg, and becomes a LARVA; a ſoft ſucculent animal, without wings, incapable of producing its ſpecies, ſlow in its motions, ſometimes without feet, but more frequently with them; conſuming greedily the kind of food which is peculiar to it, and which, in proper time, is changed into a *pupa*. Metamorphoſis.

PUPA (*Nympha*, *Chryſalis*), is firmer and drier than the larva, and is confined either by a naked membrane, or encloſed in a follicle. It is commonly without a mouth; ſometimes it has feet, but more frequently none.

1. *Completa*, complete in all their parts, and active; as the aranea, acarus, oniſcus, &c.

2. *Semicompleta*, half complete, with only the rudiments of wings; as the gryllus, cicada, cimex, libellula, and ephemera.

3. *Incompleta*, incomplete, with immoveable wings and feet; as the apis, formica, and tipula.

4. *Obtecta*, covered, having the thorax and abdomen encloſed in a ſkin, and that either naked, or encloſed in a follicle differently compoſed.

5. *Coarctata*, confined within a globe; as the muſca, œſtrus.

The pupa is converted into the *imago*, or the perfect infect.

IMAGO, is the perfect infect, active, furniſhed with antennæ, and capable of generating.

Infects are ſaid to inhabit thoſe plants on which they feed, and not thoſe on which they may be occaſionally found, and receive from them many of their ſpecific names.

LINNÆUS has divided the claſs of infects into ſeven orders.

I. COLEOPTERA, (from κωλεος, "a ſheath," and πτερον, "a wing"), are ſuch infects as have four wings, the upper pair of which are elytra, or cruſtaceous ſhells, which, when the animal is at reſt, ſhut, and form a ſtraight ſuture down the back. Claſſification.

II. HEMIPTERA, (from ημις "half," and πτερον, "a wing"), containing ſuch infects as have four wings, the ſuperior pair being half cruſtaceous, and incumbent, and a mouth or beak bent toward the breaſt.

III. LEPIDOPTERA, (from λεπος "a ſcale," and πτερον, "a wing," containing ſuch infects as have four wings covered with minute imbricated ſcales, a hairy body, and a mouth furniſhed with an involuted ſpiral tongue.

IV. NEUROPTERA, (from νευρον, "a nerve," and πτερον, "a wing"), containing ſuch infects as have four naked wings, marked with veins croſſing one another like net-work; the tail unarmed.

V. HYMENOPTERA, (from υμην, "a membrane," and πτερον, "a wing"), containing ſuch infects as have four membranaceous wings, and a tail furniſhed with a ſting.

VI. DIPTERA, (from δυο, "two," and πτερον, "a wing"), ſuch as have two wings and poiſers.

VII. APTERA, (from α, "without," and πτερον, "a wing"), ſuch as have no wings or elytra in either ſex.

CHARACTERS OF INSECTS.

Coleoptera.

I. COLEOPTERA.

The inſects belonging to this order are formed into four ſubdiviſions. 1. Thoſe that have the antennæ clavated, and thickened towards their exterior ſide. 2. Thoſe that have the antennæ moniliform. 3. Thoſe which have the antennæ filiform. 4. Thoſe which have the antennæ ſetaceous.

A. *Antennis clavatis, extrorſum incraſſatis.*

a. *Clava lamellata.*

1. SCARABÆUS. Tibiæ anteriores dentatæ.
2. LUCANUS. Penicilli duo ſub labio, palpigeri.

b. *Clava perfoliata.*

3. DERMESTES. Caput inflexum ſub thorace, vix marginato.
4. MELYRIS. Labium clavatum, emarginatum.
5. BYRRHUS. Labium porrectum, bifidum.
6. SYLPHA. Thorax et elytra marginata.
7. TRITOMA. Palpi anteriores ſecuriformes.
8. HYDROPHILUS. Maxilla bifida.

c. *Clava ſolida.*

9. HISTER. Caput retractile intra thoracem.

10. PAUSUS. Antennæ biarticulatæ. Clava uncinata.

11. BOSTRICHUS. Caput inflexum ſub thorace, vix marginato.
12. ANTHRENUS. Maxilla bifida.
13. NITIDULA. Thorax et elytra marginata.
14. COCCINELLA. Palpi anteriores ſecuriformes; poſteriores filiformes.
15. CURCULIO. Roſtrum elongatum corneum.

B. *Antennis moniliformibus.*

16. BRENTUS. Roſtrum elongatum, corneum, rectum.
17. ATTELABUS. Roſtrum elongatum, incurvum.
18. ERODIUS. Labium corneum, emarginatum.
19. STAPHYLINUS. Elytra dimidiata, alas tegentia. Veſiculæ duæ ſupra caudam exſerendæ.

20. SCAURUS. Labium truncatum integrum.
21. ZYGIA. Labium elongatum, membranaceum.
22. MELOE. Thorax ſubrotundus. Caput gibbum, inflexum.
23. TÈNEBRIO. Thorax marginatus. Caput exſertum. Corpus oblongum.
24. CASSIDA. Corpus ovatum. Elytra marginata. Caput tectum clypeo.
25. OPATRUM. Thorax et elytra marginata.
26. MORDELLA. Laminæ ad baſin abdominis. Caput inflexum.
27. CHRYSOMELA. Corpus ovatum, immarginatum.
28. HORIA. Palpi inæquales. Maxilla bifida. Labium rotundatum.

A. *The Antennæ clavated, becoming thicker towards their exterior ſide.*

a. *The Clava or Club lamellated.*

S. The ſhanks of the fore-legs dentated.
L. Two tufts under the lip, to which the feelers are attached.

b. *The Club perfoliated.*

D. The head bent under the thorax, which is ſcarcely marginated.
M. The lip clavated and emarginated.
B. The lip ſtretched out, and bifid.
S. The thorax and elytra marginated.
T. The two anterior feelers hatchet-ſhaped.
H. The jaw bifid.

c. *The Club ſolid.*

H. The head capable of being drawn back within the thorax.
P. The antennæ conſiſting of two articulations. The club hooked.
B. The head bent under the thorax, which is ſlightly marginated.
A. The jaw bifid.
N. The thorax and elytra marginated.
C. The anterior feelers hatchet-ſhaped; the poſterior filiform.
C. The beak lengthened and horny.

B. *With the Antennæ moniliform.*

B. The beak elongated, horny and ſtraight.

A. The beak elongated and crooked.
E. The lip horny and emarginated.
S. The elytra half the length of the body, covering the wings. Two veſicles above the tail, which can be puſhed out at pleaſure.
S. The lip truncated, and entire.
Z. The lip elongated and membranaceous.
M. The thorax roundiſh. The head gibbous, and bent inwards.
T. The thorax marginated. The head ſtretched out. The body oblong.
C. The body oblong. The elytra marginated. The head covered with a ſhield.
O. The thorax and elytra marginated.
M. Laminæ at the baſe of the abdomen. Head inflected.
C. The body oval, immarginated.
H. Feelers unequal. Jaw bifid. Lip rounded.

C. *Antennæ*

C. *Antennis filiformibus.*

29. APALUS. Thorax ſubrotundus. Caput gibbum, inflexum.

30. MANTICORA. Maxillæ exſertæ, dentatæ. Oculi prominuli.

31. PIMELIA. Thorax marginatus. Caput exſertum. Corpus oblongum.

32. GYRINUS. Antennæ rigidulæ. Oculi quatuor.

33. CUCUJUS. Labium breve, bifidum, laciniis diſtantibus.

34. CRYPTOCEPHALUS. Corpus ovatum immarginatum.

35. BRUCHUS. Antennæ extrorſum craſſiores.

36. PTINUS. Thorax caput recipiens. Antennæ articulis ultimis longioribus.

37. HISPA. Antennæ porrectæ, approximatæ, fuſiformes.

38. BUPRESTIS. Caput dimidium, intra thoracem retractum.

39. NECYDALIS. Elytra dimidiata, alis nudis.

40. LAMPYRIS. Elytra flexilia. Thoracis clypeus caput obumbrans recipienſque.

41. CANTHARIS. Elytra flexilia. Abdomen lateribus plicato-papilloſum.

42. NOTOXUS. Labium bifidum; laciniis conniventibus obtuſis.

43. ELATER. Pectoris mucro è poro abdominis reſiliens.

44. CALOPUS. Thorax ad latera mucronato-calloſus.

45. ALURNUS. Maxilla fornicata.

46. CARABUS. Thorax obcordatus, poſterius truncatus.

47. LYTTA. Thorax ſubrotundus. Caput gibbum inflexum.

D. *Antennis ſetaceis.*

48. SERROPALPUS. Palpi anteriores profundè ſerrati.

49. CERAMBYX. Thorax ad latera mucronato-calloſus.

50. LEPTURA. Elytra apice attenuata. Thorax teretiuſculus.

51. RHINOMACER. Antennæ roſtro inſidentes.

52. ZONITIS. Labium emarginatum.

53. CICINDELA. Maxillæ exſertæ, dentatæ. Oculi prominuli.

54. DYTISCUS. Pedes poſteriores ciliati, natatorii.

55. FORFICULA. Elytra dimidiata. Alis tectis. Cauda forcipata.

Hemiptera.

II. HEMIPTERA.

56. BLATTA. Os maxilloſum. Alæ coriaceæ, planæ. Pedes curſorii.

57. PNEUMORA. Os maxilloſum. Alæ membranaceæ, deflexæ. Pedes curſorii. Corpus cavum, inflatum, diaphanum.

58. MANTIS. Os maxilloſum. Pedes anteriores ferrati, ungue unico.

59. GRYLLUS. Os maxilloſum. Pedes poſteriores ſaltatorii.

C. *Antennæ filiform.*

A. Thorax roundiſh. Head turgid, inflected.

M. Jaws ſtretched out, furniſhed with teeth. Eyes rather prominent.

P. Thorax margined. Head ſtretched out. Body oblong.

G. Antennæ a little rigid. Eyes 4.

C. Lip ſhort, bifid, the diviſions diſtant.

C. Body oval, immarginated.

B. Antennæ growing thicker towards the external edge.

P. Thorax receiving the head: laſt joints of the antennæ longer than the reſt.

H. Antennæ ſtretched forwards, approaching one another, and ſpindle-ſhaped.

B. Head half retracted within the thorax.

N. Elytra half the length of the body. Wings naked.

L. Elytra flexible. Shield of the thorax ſhading and receiving the head.

C. Elytra flexible. Sides of the abdomen edged with folded papillæ.

N. Lip bifid; the diviſions of it obtuſe and approaching cloſely.

E. A ſharp point proceeding from the breaſt, ſpringing out at a pore in the abdomen.

C. The thorax callous at the ſides, and ſet with ſharp points.

A. Jaw arched. Feelers 6.

C. The thorax reſembling a heart inverted, and terminating abruptly behind.

L. Thorax roundiſh. Head turgid, inflected.

D. *Antennæ ſetaceous.*

S. The anterior feelers deeply ſerrated.

C. The thorax callous at the ſides, and ſet with ſharp points.

L. Elytra tapering towards the tip. Thorax roundiſh.

R. Antennæ ſeated on the ſnout.

Z. Lip emarginated.

C. Jaws ſtretched out, furniſhed with teeth. Eyes a little prominent.

D. Hind-legs fringed, formed for ſwimming.

F. Elytra half as long as the body. Wings covered. Tail furniſhed with pincers.

II. HEMIPTERA.

B. Mouth furniſhed with jaws. Wings coriaceous, plane. Legs formed for running.

P. Mouth furniſhed with jaws. Wings membranaceous, deflected. Legs formed for running. Body hollow, inflated, and tranſparent.

M. Mouth furniſhed with jaws. The anterior legs ſerrated, and terminated by a ſingle claw.

G. Mouth furniſhed with jaws. Hind-legs formed for leaping.

60.

60. Fulgora. Roſtrum inflexum. Frons producta, inermis. Antennæ capitatæ.
F. Snout inflected. Fore-head projecting, unarmed. Antennæ capitated.

61. Cicada. Roſtrum inflexum. Pedes poſteriores ſaltatorii.
C. Snout inflected. Hind-legs formed for leaping.

62. Notonecta. Roſtrum inflexum. Pedes poſteriores natatorii (ciliati).
N. Snout inflected. Hind-legs fringed and formed for ſwimming.

63. Nepa. Roſtrum inflexum. Pedes anteriores cheliferi.
N. Snout inflected. Fore-legs furniſhed with claws.

64. Cimex. Roſtrum inflexum. Pedes curſorii. Antennæ thorace longiores.
C. Snout inflected. Legs formed for running. Antennæ longer than the thorax.

65. Macrocephalus. Roſtrum inflexum. Antennæ breviſſimæ.
M. Snout inflected. Antennæ very ſhort.

66. Aphis. Roſtrum inflexum. Abdomen bicorne.
A. Snout inflected. Abdomen 2-horned.

67. Chermes. Roſtrum pectorale. Pedes poſteriores ſaltatorii.
C. Snout placed in the breaſt. Hind-legs formed for leaping.

68. Coccus. Roſtrum pectorale. Abdomen (maribus) poſterius ſetoſum.
C. Snout placed in the breaſt. Abdomen (in the males) terminating in briſtles.

69. Thrips. Roſtrum obſoletum. Alæ incumbentes, abdomine reflexile.
T. Snout obſolete. Wings incumbent. The abdomen capable of being turned up.

Lepidoptera.

III. LEPIDOPTERA.

III. LEPIDOPTERA.

70. Papilio. Antennæ extrorſum craſſiores. Alæ erectæ.
P. Antennæ thicker towards the point. Wings erect.

71. Sphinx. Antennæ medio craſſiores.
S. Antennæ thicker in the middle.

72. Phalena. Antennæ introrſum craſſiores.
P. Antennæ thicker towards the baſe.

Neuroptera.

IV. NEUROPTERA.

IV. NEUROPTERA.

73. Libellula. Cauda forcipata. Os multi maxillоſum. Alæ extenſæ.
L. Tail forked. Mouth with many jaws. Wings expanded.

74. Ephemera. Cauda ſetis 2 et 3. Os edentulum. Alæ erectæ.
E. Tail with 2 and 3 briſtles. Mouth without teeth. Wings erect.

75. Myrmeleon. Cauda forcipata. s bidentatum. Alæ deflexæ.
M. Tail forked. Mouth with two teeth. Wings deflected.

76. Phryganea. Cauda ſimplex. Os edentulum. Alæ deflexæ.
P. Tail ſimple. Mouth without teeth. Wings deflected.

77. Hemerobius. Cauda ſimplex. Os bidentatum. Alæ deflexæ.
H. Tail ſimple. Mouth with two teeth. Wings deflected.

78. Panorpa. Cauda chelata. Os roſtratum. Alæ incumbentes.
P. Tail furniſhed with a claw. Mouth ſtretched out into a beak. Wings incumbent.

79. Raphidia. Cauda filo 1. Os bidentatum. Alæ deflexæ.
R. Tail ending in a ſimple thread. Mouth with two teeth. Wings deflected.

Hymenoptera.

V. HYMENOPTERA.

V. HYMENOPTERA.

80. Cynips. Aculeus ſpiralis!
C. Sting ſpiral.

81. Tenthredo. Aculeus ſerratus! bivalvis.
T. Sting ſerrated, two-valved.

82. Sirex. Aculeus ſerratus, ſub abdominis ſpina terminali.
S. Sting ſerrated, under a ſpine which terminates the abdomen.

83. Ichneumon. Aculeus exſertus! triplex.
I. Sting ſtretched out, triple.

84. Sphex. Aculeus punctorius. Alæ planæ. Lingua inflexa, trifida.
S. Sting pungent. Wings ſmooth. Tongue inflected, and divided into three at the extremity.

85. Scolia. Lingua inflexa, trifida. Labium apice membranaceum.
S. Tongue inflected, trifid. Lip membranaceous at the extremity.

86. Thynnus. Lingua breviſſima, involuta. Labium trifidum.
T. Tongue very ſhort, involuted. Lip trifid.

87. Leucopsis. Labium maxilla longius, emarginatum. Antennæ clavatæ.
L. Lip longer than the jaw, notched. Antennæ clavated.

88. Tiphia. Labium breve, corneum, tridentatum.
T. Lip ſhort, horny, with three ſmall diviſions.

89. Chalcis. Antennæ breves, cylindricæ, fuſiformes.
C. Antennæ ſhort, cylindrical, ſpindle-ſhaped.

90. Chrysis. Aculeus punctorius. Abdomen ſubtus fornicatum.
C. Sting pungent. Abdomen arched beneath.

91. Vespa. Aculeus punctorius. Alæ superiores plicatæ!
92. Apis. Aculeus punctorius. Lingua inflexa!
93. Formica. Aculeus obsoletus. Alæ neutris nullæ!
94. Mutilla. Aculeus punctorius. Alæ neutris nullæ.

V. Sting pungent. Upper wings folded.

A. Sting pungent. Tongue inflected.
F. Sting obsolete. Neuters without wings.

M. Sting pungent. Neuters without wings.

Diptera.

VI. DIPTERA.

A. *Proboscide et Haustello.*

95. Diopsis. Caput bicorne. Oculis terminalibus.
96. Tipula. Haustellum sine vagina. Palpi 2, porrecti, filiformes.
97. Musca. Haustellum sine vagina, setis instructum.
98. Tabanus. Haustellum vagina univalvi, setisque instructum.
99. Empis. Proboscis inflexa.
100. Conops. Proboscis porrecta, geniculata.

B. *Haustello sine Proboscide.*

101. Oestrus. Haustellum retractum intra labia, connata poro pertusa.
102. Asilus. Haustellum rectum bivalve, basi gibbum.
103. Stomoxys. Haustellum vagina univalve convoluta, basi geniculata.
104. Culex. Vagina exserta, univalvis, flexilis, setis 5.
105. Bombylius. Haustellum longissimum, rectum, setaceum, bivalve.
106. Hippobosca. Haustellum breve, cylindricum, rectum, bivalve.

VI. DIPTERA.

A. *With Proboscis and Sucker.*

D. Head two-horned. Eyes terminal.
T. Sucker without a sheath. Feelers 2, projecting, filiform.
M. Sucker without a sheath, furnished with bristles.

T. Sucker with a single-valved sheath, furnished with bristles.
E. Proboscis inflected.
C. Proboscis projecting, and bent with an angular flexure.

B. *With Sucker, but no Proboscis.*

O. Sucker drawn back within the lips, which are perforated.
A. Sucker straight, with two valves, turgid at the base.
S. Sucker with a single-valved convoluted sheath, bent at the base, with an angular flexure.
C. Sheath stretched out, of one flexible valve, with 5 bristles.
B. Sucker very long, straight, setaceous, with two valves.
H. Sucker short, cylindrical, straight, with two valves.

Aptera.

VII. APTERA.

A. *Pedibus sex, Capite à Thorace discreto.*

107. Lepisma. Cauda setis exsertis.
108. Podura. Cauda bifurca, inflexa, saltatrix.
109. Termes. Os maxillis duabus. Labium corneum, quadrifidum.
110. Pediculus. Os aculeo exserendo.

111. Pulex. Os rostro inflexo, cum aculeo. Pedes saltatorii.

B. *Pedibus 8—14. Capite Thoraceque unitis.*

112. Acarus. Oculi 2. Pedes 8. Palpi compressi.
113. Hydrachna. Oculi 2—8. Pedes 8, in anteriore corporis parte. Papillæ textoriæ.

114. Aranea. Oculi 8. Pedes 8. Papillæ textoriæ. Palpi clavati.

115. Phalangium. Oculi 4. Pedes 8. Palpi chelati.
116. Scorpio. Oculi 8. Pedes 8. Palpi chelati.
117. Cancer. Oculi 2. Pedes 10, primo chelato.

VII. APTERA.

A. *Legs six. Head distinct from the Thorax.*

L. Tail ending in setaceous bristles.
P. Tail forked, inflected, elastic.
T. Mouth with two jaws. Lip horny, cleft into four pièces.
P. Mouth armed with a sting capable of being pushed out at pleasure.
P. Snout inflected, armed with a sting. Feet formed for leaping.

B. *Legs 8—14. Head and Thorax united.*

A. Eyes 2. Legs 8. Feelers compressed.

H. Eyes 2—8. Legs 8. Abdomen furnished with papillæ, with which the animal spins thread and weaves itself a web.
A. Eyes 8. Legs 8. Abdomen furnished with papillæ, with which the animal spins thread and weaves itself a web.
P. Eyes 4. Legs 8. Feelers furnished with claws.

S. Eyes 8. Legs 8. Feelers furnished with claws.
C. Eyes 2. Legs 10, the first pair furnished with claws.

118. Monoculus. Oculi 2. Pedes 12, decem chelatis.

119. Oniscus. Oculi 2. Pedes 14.

C. *Pedibus pluribus. Capite à Thorace discreto.*

120. Scolopendra. Corpus lineare.

121. Julus. Corpus subcylindricum.

M. Eyes 2. Legs 12, 10 of them furnished with claws.

O. Eyes 2. Legs 14.

C. *Legs numerous. Head distinct from the Thorax.*

S. Body linear.

J. Body nearly cylindrical.

N. B.—*In the following classification, some of the more remarkable species only are enumerated. Those marked with an asterisk are natives of Britain.*

I. COLEOPTERA.

Elytra covering the wings.

Scarabæus. 1. Scarabæus, *Beetle.*

Antennæ clavated, the club lamellated. Feelers 4. Jaws horny, for the most part without teeth. The shanks of the fore-legs generally dentated.

The larvæ of the genus *scarabæus* have six feet, and a body composed of annular segments, furnished with hairs, and with vesicles at the end of the abdomen. Their heads are hard, formed of a substance like horn. They are commonly called *grubs*, and do much mischief, both in the fields and in the garden. They live chiefly under ground, or in dung, on which they frequently feed. The larvæ of the species *cetonia* live on rotten wood, and those of the *melolontha* on the roots of plants. The *pupa* remains under ground.—Grubs are devoured by many kinds of birds, particularly by the rooks, which, on that account ought not to be destroyed so eagerly as they are in many places; for, though they do much mischief themselves, in spring, and during harvest, yet it is amply compensated by the good they do through the year, in clearing the ground of grubs.

* *Feelers filiform.*

† *Jaw arched.*

a. *Without teeth.*

N. *Thorax horned.*

α. *Scutellati.*

* *hercules.* A horn on the thorax, large, and bent inwards, barbed below with one tooth; a horn on the head bent back, dentated on the upper side with many teeth. *Syst. Nat. Lin.* 1. It is a native of America, and varies in colour, being sometimes black, sometimes azure spotted with black. The female is without horns.

* *centaurus.* The horn on the thorax bent inwards, with two teeth at its base, and bifid at the point; the horn on the head bent back, furnished with one tooth. 92.

chorinæus. The horn on the breast bent inwards and very thick at the base, bifid at the point; the horn of the head bent back, very long, bifid. Native of Brasil. 96.

* *typhæus.* *Bull-comber.* With three horns on the thorax, the middle ones smaller than the rest, lateral ones projecting as far as the head does, which is without horns. It is a native of Europe; to be met with under cow-dung. It makes its nest in holes, which it digs deep into the ground. It is black. Head depressed, hairy at the sides, narrow. Knob of the antennæ grayish. Thorax smooth. The horns sometimes as long as the head, and sometimes twice as long; in the female hardly visible. Elytra striated. Shanks hairy. 9.

* *mobilicornis.* Thorax with four projections like teeth. The horn of the head bent back, and moveable. 116. Native of England and Germany. Black. Elytra striated. Female without horns on the head, or projections on the breast.

actæon. Smooth; thorax with two horns; horn of the head notched with one tooth, bifid at the end; elytra smooth. 3. Native of South America. The largest of all known insects, except crabs and monoculi. Elytra black, or azure spotted with black.

N. *Thorax horned.*

β. *Without Scutellum.*

violaceus. Thorax with six spines; jaws prominent; front sloping; body entirely of a violet colour. 117. Native of Siberia; found under stones; small. Elytra marked with deeply excavated spots.

oedipus. Horn of the thorax flat, marked with one tooth on the under side; the horn of the head terminating abruptly, with three teeth. 119. Native of the Cape of Good Hope. Middle-sized.

* *lunaris.* Thorax with three horns, the middle one obtuse, and bifid; horn of the head erect; shield emarginated. 10. Native of Europe; on dunghills. The female always without horns on the breast.

camelus. Thorax marked with four projections like teeth; posterior part of the shield slightly marked with two horns; body black. 134. Native of Germany. The female with nearly the same marks as the male.

b. *Thorax unarmed; Head horned.*

a. *Furnished with a Scutellum.*

bilobus. Thorax prominent, divided into two lobes; horn of the head simple; elytra striated. 12. Native of the south of Europe. Black.

nasicornis. A triple prominence on the breast; horn on the head bent back; elytra smooth. 15. Native of Europe; met with in dunghills. Its larva gray, with a reddish head, feet, and spiracula or breathing holes. Swammerdam has supposed it to be the *cossus* of the ancients. Vid. *Plin.* 17. 24. Thorax of the female roundish.

β. *Without Scutellum.*

jacchus. Thorax prominent, formed of two lobes; horn on the head bent back, and simple. 156. Native of the Cape of Good Hope. The horn on the head of the female very short, and terminating abruptly.

carnifex. Thorax flat, angularly rough; the horn on the head bent

bent inwards; the body of a yellow colour. 22. Native of America. During the whole ſummer they may be ſeen in great numbers, rolling about balls which they form out of dung. They mutually aſſiſt one another to roll them into holes made for their reception, like the *pilularis*. Their bodies are broad, and depreſſed; the horn on their heads is placed backwards. It is black, and ſmooth. In the female it is effaced.

c. *Both Thorax and Head without horns.*

a. *Furniſhed with a Scutellum.*

* *fimetarius.* *Dunghill-beetle.* Body black; head marked with tubercles, commonly three in number; the elytra reddiſh. 32. Native of Europe; frequently to be met with in dung.

* *ſtercorarius.* *Clock-beetle.* Body black, ſmooth; the elytra furrowed; the head of a rhomboidal figure; fore-head prominent. 42. Native of Europe; to be met with in dung; much infeſted with ſome ſpecies of the *acarus* and *ichneumon*, and, on that account, frequently called *louſy beetle*. It flies about in the evening with a loud noiſe, and is ſaid to foretel a fine day. It was conſecrated by the Egyptians to the ſun. It is ſometimes of a greeniſh blue colour. It is likewiſe ſometimes yellowiſh below, with duſky-red elytra. This is the *ſhard-borne beetle* of Shakeſpeare. The female digs a hole, and kneads a lump of freſh dung, generally of a cylindrical ſhape, on which ſhe depoſits one egg, and then covers it with more dung, attaching it to the root of ſome graſs. In a few days the larva breaks the egg, and feeds on the freſh dung. During the autumn it changes its ſkin four times.

β. *Without Scutellum.*

facer. The ſhield of the head marked with ſix denticulations; the thorax notched; the ſhanks of the hind-legs fringed; top of the head marked with two ſlight projections. 18. Native of the ſouthern parts of the old continent. It is frequent in dry ſituations in the ſouthern parts of Ruſſia, where it rolls about cylinders formed of cow-dung. Its figure is carved by the Egyptians on the ancient pillars at Rome.

pilularius. Black, opaque, ſmooth, yellow underneath; the thorax rounded behind. 40. Native of the ſouth of Europe; of the ſame ſize with the louſy beetle. In pairs, they daily roll, like Siſyphus, a ball made of excrement, ſeven times the bulk of their own body.

ſchaefferi. The thorax round; the ſhield emarginated; the elytra triangular; the thighs of the hind-legs elongated and dentated. 41. Native of Italy, Germany, and Siberia; to be met with on the ſunny hills, where it rolls and buries balls made of cow-dung. It is black.

* *foſſor.* Thorax retuſe; head marked with three tubercles, the middle one faintly reſembling a horn. 31. A native of Europe, in ſandy places, and in dunghills.

b. *Jaw arched, furniſhed with ſome teeth; the point of the Abdomen naked, and obliquely truncated.* Melolonthæ.

* *fullo.* Of a brick colour, and ſpotted with white. The ſcutellum with two notches; the antennæ divided into ſeven leaves. 57. It inhabits ſandy ſituations in Europe and Barbary, living on the oak, *elymus arenaria*, and *arundo arenaria*. It is hairy below: the hooks at the ends of their legs are furniſhed, at their baſe, with a crooked branch. It is the largeſt coleopterous inſect to be met with in Britain, except the ſtag-beetle. It is but rare in England.

The head and thorax beſet with bluiſh hair; the elytra of a livid colour; the ſhield bent back at the top. 236. Native of Germany; on the ears of rye. *fruticola*

The head and thorax beſet with bluiſh hairs; the elytra of a brick colour; the legs black. 59. Native of Europe; to be found in gardens, where its grub proves very deſtructive to cabbages, &c. and the beetle to the fruit-trees. * *hortico-la.*

The thorax hairy; the elytra of a livid colour, with a black edge, and black band; the ſhield turned back at the top. 58. Native of Europe, on graſs-fields. *agricola.*

The head and thorax covered with bluiſh hairs; the elytra reddiſh; the abdomen white and hairy. 40. Native of Europe; reſembles the garden-beetle very much, and is very deſtructive. *abdominalis.*

Of a ſhining copper colour; the ſhield emarginated. 241. Native of Africa, near the equator. *regius.*

Green; the ſides of the thorax yellow. 249. A native both of Europe and America; on the vine: very like the *friſchii*, differing only from it by the elytra, which are of a brick colour. *vitis.*

Blackiſh yellow; the elytra of a brick colour. 250. Is a native of Germany; on the vine, and the roſe. The elytra, ſometimes, are of the ſame colour with the thorax. *friſchii.*

Above ſmooth, and of a golden colour; the ſcutellum, and a line on the back of the thorax, of a blood-colour. 253. A native of New Zealand. *laetus.*

Door-beetle, *May-bug*, *Cockchaffer*. Furniſhed with a ſcutellum; without horns; light brown; the thorax hairy; the tail bent inwards; a triangular white ſpot at each inciſure of the abdomen. 60. It inhabits the northern parts of Europe; flies about in the evening, and feeds on the leaves of trees. It is the moſt deſtructive of all the European inſects. When it happens to be more plentiful than uſual, in the autumn, the vulgar entertain an opinion, that ſome epidemic diſeaſes are to follow. The male is diſtinguiſhed by a ſharp inflected tail. The grub is gray, with reddiſh brown head and feet. Eats the roots of plants, particularly of corn, frequently laying waſte a great tract of country. They remain ſix years under ground, before they become beetles. Their thorax varies yearly in colour, from brown to black. * *melolontha.*

It is furniſhed with a ſcutellum, and is without horns; the thorax is hairy; the elytra are of a pale yellow colour, marked with three white parallel lines. 61. Is a native of Europe, to be met with among trees. The claws at the end of the legs, have one little projection, like a tooth, at their baſe. They make their appearance ſomewhat later than the May-bug, and are very frequent about the ſummer ſolſtice. *ſolſtitialis.*

Body of a brick colour, and woolly below; ſhield marginated, and bent back; ſcutellum white. 263. Native of Europe; of the ſame ſize with the cockchafer. *villoſus.*

†† *Jaw ſtraight.*

a. *Sharp.* Cetoniæ.

Furniſhed with a ſcutellum; without horns; ſternum projecting; ſcutellum one half ſhorter than the elytra. 49. Native of South America. Of the ſame ſize and colour with the golden beetle. * *ryſis.*

faſcicularis. Furniſhed with a ſcutellum; thorax marked with four ſmall white lines; elytra green; inciſures of the abdomen bearded. 75. Native of the Cape of Good Hope. Covered on the under part of the body with pale red wool, collected into little bundles.

b. *Jaws ſtraight and blunt.* Friſchii.

* *faſciatus.* Furniſhed with a ſcutellum; body black, covered with yellow down; elytra marked with two yellow bands uniting into one. 70. Native of the north of Europe: feeding on the flowers of the *ſyringa*, *filipendula*, and on ſome umbelliferous plants.

* *hemipterus.* Furniſhed with a ſcutellum; thorax downy, edged with two longitudinal wrinkles; elytra ſhortened. 63. Native of Europe. The larva is found in wood; the beetle on flowers. The female is armed with a ſtiff, ſhort ſting.

** *Feelers terminating in knobs.* Trox.

* *fabulòſus.* Furniſhed with a ſcutellum; black, opaque, with wrinkled tubercles; antennæ hairy at the baſe. 48. Native of Europe. To be met with on ſandy hills, which are expoſed to the ſunſhine.

mortícinii. Shield unequal and fringed; elytra ſtriated, and marked with convex ſharpiſh points. 404. Native of Tartary. To be found in great numbers, under dead bodies, which have been dried by the ſun. It makes a noiſe, by rubbing its tail againſt its elytra. Is of an opaque black colour; and of the ſame ſize with *ſc. foſſor.*

*** *Feelers cylindrical: the Club of the Antennæ tunicated.*

hemiſphæricus. Hemiſpherical; the fore part of the ſhield marked with two obtuſe projections. 406. Larger than the *ſc. ſacer.*

432 ſpecies of this genus, have been deſcribed by Gmelin, in his laſt edition of the Syſtem of Nature.

2. Lucanus.

Antennæ clavated; the club compreſſed, being broadeſt at the ſides, and divided into pectinated leaves. Jaws ſtretched out, and forked at the points. Two tufts under the lip, to which the feelers are attached.

alces. The jaws ſtretched out, and furniſhed with four teeth at the point. 8. A native of Aſia.

* *cervus.* *Stag-beetle.* Furniſhed with a ſcutellum; the jaws ſtretched out, and forked at the points, furniſhed with one lateral tooth. 1. Native of Europe. It is the largeſt coleopterous inſect to be met with in Britain. It feeds on decayed oak. The larva is white and very thick, with head and feet of a ruſty colour. By ſome ſuppoſed to be the *craſſus* of the ancients. The female ſmaller than the male.

elaphus. The jaws projecting, furniſhed with one tooth, and forked at the point; the lip conical and bent down. 9. Native of Virginia. In the female, which is ſmaller than the male, the jaws do not project.

capreolus. Furniſhed with a ſcutellum; the jaws projecting, and only forked at the point. 2. It is a native of the ſouth of Europe, and North America; about half the ſize of the ſtag-beetle.

20 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

3. Dermestes, *Leather-Eater.*

Antennæ clavated; club perfoliated; three articulations thicker than the reſt. Thorax convex, ſlightly marginated. Head bent and concealed under the breaſt.

The *larvæ*, or grubs, of this tribe, devour dead bodies, ſkins, leather, and almoſt any animal ſubſtance; and are exceedingly deſtructive to books and furniture.

* *Jaw bifid.*

* *lardarius* Black; the fore part of the elytra of an aſh colour. 1. It is a native of Europe. Sometimes, though rarely, the anterior part of the elytra is of a ruſty colour.

This inſect is the common peſt of muſeums, libraries, and preparations of natural hiſtory. It is alſo found in old bacon, whence it has received its name. When it is eating, it protrudes balls of excrement from its anus, which hang down in a ſtring. The larva is oval and hairy.

elongatus. Black; the elytra livid at the baſe, and marked with a band of the ſame colour, at the poſterior part; the antennæ and feet of a ruſty colour. 2. Native of Europe; to be met with in old wood; almoſt filiform.

* *undatus.* Oblong, black; the elytra marked with a double white linear band. 3. A native of Europe. Feeds on putrid animal ſubſtances.

* *pellio.* Black; the elytra marked with two white ſpots. 4. It is a native of Europe. Feeds on ſkins, bacon, and old books. Its larva is oblong, hairy, and furniſhed with a briſtly tail.

* *paniceus.* Oblong, of a ruſty colour; with red eyes. 19. Native of Europe. In bread that has been long kept; in bookbinders glue; in books, &c. About the ſize of a millet ſeed. The larva is oblong, white and ſhining.

** *Jaw furniſhed with one tooth.* Apate.

muricatus. The elytra reticulated, blunted behind and notched; thorax prickly and turgid. 6. It is a native of South America; in wood, and ſugar canes.

ruficornis. Of a duſky colour; the head drawn back; the antennæ and feet reddiſh. 70. It is a native of Europe, and very ſmall.

70 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

4. Bostrichus.

Antennæ clavated; the club ſolid. Thorax convex, and ſcarcely marginated. Head inflected and concealed under the thorax.

capucínus. Black; the elytra and abdomen red; the thorax flattened. 1. It is a native of Europe, and of Siberia. It is to be found in trunks of trees, paticularly dead ones, and in houſes.

* *typogra-phus.* Of a brick colour; hairy; the elytra ſtriated, blunted and notched. 4. It is a native of Europe, and America; to be met with under the bark of trees. It is particularly hurtful to the pine tree; very prolific, and very voracious; ſcooping out furrows under the bark, from which other ſmaller ones proceed, in a parallel direction. They are very tenacious of life; and according to age and ſize, vary in colour, from a yellow to a brown, and from that to black.

chalcogra-phus. Black; the elytra red, and notched. 5. It is a native

tive of Europe; to be found under the bark of trees. It sometimes varies in colour.

polygraphus. Blackish; the elytra are sometimes blunted, and of an azure colour. 6. It is a native of Europe. It forms winding canals under the bark of trees, and is one of the most destructive of this genus.

* *micrographus.* Of a rusty colour; the elytra entire, and of a brick colour. 7. It is a native of Europe; in wood, also within the bark of trees; small, black; the elytra, antennæ, and legs, of a brick colour.

* *piniperda.* Black, and somewhat hairy; the elytra entire, and black; the feet reddish. 13. It is a native of Europe; on the under branches of pine-trees, which it perforates, dries up, and destroys. It sometimes varies in the colour of the elytra.

22 species of this genus have been described in the last edition of the System of Nature.

5. Melyris.

Lip clavated, and emarginated. Antennæ perfoliated throughout their whole length. Jaw with one tooth, and pointed.

viridis. Green; the elytra marked with three elevated lines. 1. Native of the Cape of Good Hope.

nigra. Black; the elytra marked with three elevated lines. 2. About the third part of the size of the preceding species.

6. Ptinus.

Antennæ filiform; the articulations towards the points larger than the rest. Thorax roundish, not marginated, receiving the head.

* *Feelers clavated.* Anobia.

rugosus. Brown; thorax unequal; elytra striated. 1. It is a native of Europe; without spots, and double the size of the subsequent species.

* *pertinax.* All over brown. 2. It is a native of Europe; is very destructive to wooden furniture, particularly to articles made of oak; likewise to books, &c. When catched, it contracts itself and counterfeits death. It can be put in motion again, neither by pricking, nor any other means, except by the application of a strong heat. It is destroyed by the *attelabus formicarius.*

* *mollis.* Of a brick colour, with dark-coloured eyes. 3. It is a native of Europe, amongst rubbish; an unwelcome visitor in collections of plants, and to be got rid of effectually, in no other way, but by the heat of an oven. The larva is white, and is capable of enduring a great degree of cold.

* *pulsator.* *Death-watch.* Cylindrical, opaque, and much wrinkled, sprinkled with gray spots. 13. It is a native of Europe. It is common in trunks of old trees, particularly of the willow, and in houses. It beats, especially in the night time, making a noise resembling that produced by one's nail struck against a table. This is done by seven, nine, or eleven distinct strokes, and has been considered, by the vulgar, as foreboding some fatal occurrence to the family occupying the house in which the noise is heard. But, it is nothing more than the call of one sex to the other.

** *Feelers filiform, bifid.* Ptini.

* *fur.* Light brown, and almost without wings; the thorax marked with four projections like teeth; the elytra marked with two white bands. 5. It is a native of Europe, and is exceedingly destructive to seeds, museums, books, furniture, preserved subjects of natural history, and even to the leaves of tobacco. It delights in cold and moisture; and is best kept off by heat and dryness, by arsenic or alum. It is most effectually destroyed by corrosive sublimate. The female is without wings. The larva has six feet, and is soft, thick, and hairy. The pupa is enclosed in a glutinous spherical covering.

* *imperialis.* Brown; the thorax somewhat crenated; the elytra marked with a white blotch, divided into lobes. 4. It is a native of the north of Europe; to be found in trees. It is about the size of a grain of wheat: the antennæ are of the same length with the body; the legs are of a rusty colour; the scutellum white; the elytra marked with a white spot, resembling the eagle worn on the imperial standard; from whence it has received its name.

* *scotius.* The thorax black, and smooth; the elytra connected, shining, brown. 22. It is a native of Europe; on the birch.

32 species of this genus have been described in the last edition of the System of Nature.

7. Hister.

Antennæ clavated. Club solid, the lower joint compressed, and bent down. Head capable of being drawn back into the body. Mouth furnished with pincers. Elytra shorter than the body. Shanks of the forelegs notched.

maximus. Very large. 1. It is a native of India, similar to the *unicolor*, but ten times larger. The corners of the thorax rounded; point of the breast extended, not quite up to the mouth.

* *unicolor.* Black; the elytra obliquely striated. 3. It is a native of Europe and America; in sand, and in dung.

* *bimaculatus.* Black; the posterior part of the elytra red. 5. Native of Europe; in cow dung.

17 species of this genus have been described in the last edition of the System of Nature.

8. Gyrinus, *Whirler*, or *Water-flea.*

Antennæ cylindrical. Jaw very sharp, and horny. Eyes four; two above, and two below.

These little animals are found on the surface of water, on which they run very nimbly, and describe circles. When attempted to be taken, they dive down, drawing after them a bubble, resembling a globe of quicksilver.

* *natator.* Black; faintly striated. 1. Native of Europe; in lakes and ponds.

bicolor. Black above; below, of a rusty colour; hind-legs compressed. 3. Native of Europe; frequents waters; is larger than the *natator.*

Nine species of this genus have been described in the last edition of the System of Nature.

9. Byrrhus.

Antennæ clavated, and perfoliated. Feelers equal, and somewhat clavated. Jaw bifid. Lip bifid.

gigas. Black; the elytra of a rusty colour, and marked with points. 1. Native of Europe. The anus of the female furnished with a sting.

* *pilula.* Brown; the elytra marked with black grooves. 4. Native of Europe; in sandy places. It is sometimes, though rarely, black.

* *varius.* Black; thorax of a bright yellow; elytra brown, and marked with three short green grooves, spotted with black. 5. Native of Britain.

Nine species of this genus have been described in the last edition of the System of Nature.

10. Anthrenus.

Antennæ clavated. Club solid. Feelers unequal, filiform. Jaws membranaceous, linear, bifid. Lip entire.

pimpinellæ. Black; elytra marked with a white band, and of a rusty colour towards their points, with a white stain. 4. Native of Europe; feeds on the flowers of the *pimpinella*.

* *scrophulariæ.* Black; elytra spotted with white; suture of a blood-red colour. 1. Native of Europe; on the *scrophularia*.

* *museorum.* Clouded; elytra slightly clouded. 2. Found in museums, destroying animals preserved in them, and books.

* *verbasci.* Black; elytra marked with three waved bands. 3. Native of Europe; on the *verbascum*.

Seven species of this genus have been described in the last edition of the System of Nature.

11. Sylpha, *Carrion-Beetle.*

Antennæ clavated. Club perfoliated. Elytra marginated. Head prominent. Thorax flattish, marginated.

These are chiefly found under the loose bark of trees, or on the half-decayed carcases of animals, upon which both the grub and the insect feed.

* *germanica.* Oblong, black; shield roundish, unequal, and marginated; elytra very obtuse, with a rusty coloured lateral margin. 1. Native of Germany. There are many varieties of this species. They deposit their eggs in the carcases of other insects, which they bury under ground.

* *vespillo.* Oblong, black; shield almost spherical and unequal; elytra marked with a double rusty-coloured band. 2. Native both of Europe and America.—There are many varieties of this species. In America, some of them are ten times larger than those in Europe. They frequently have the smell of musk, and fly very quickly, with their elytra erect, and applied close together. They are much infested by the *acarus*, and deposit their eggs in the carcases of other insects, which they bury.

* *quadripustulata.* Black, oblong; elytra marked with two rusty spots. 5. Native of Europe and America, in decayed wood; very smooth; the larva oblong, gray and hairy.

* *quadrimaculata.* Red; thorax and elytra black; the latter marked with two red spots. 27. Native of Europe.

* *rufifrons.* Oblong, smooth, black; the front, the legs, and two spots on the elytra, of a rusty colour. 41. Native of England. Antennæ black; club reddish; thorax smooth, without spots; elytra smooth.

* *rugosa.* Blackish; elytra wrinkled, and marked with three elevated lines; thorax wrinkled and scolloped behind. 16. Native of Europe and Asia. It consumes dead bodies, either flesh or fish. When catched, it vomits a very fœtid fluid.

94 species of this genus are described by Gmelin, in the last edition of the System of Nature.

12. Nitidula.

Antennæ clavated. Club solid. Elytra marginated. Head prominent. Thorax a little flattened, and marginated.

* *Lip square.* Elophori.

* *aquatica.* Brown; thorax wrinkled, which, together with the elytra, are of a browniish yellow. 1. A native of Europe, in stagnant waters; very small, and frequently to be found among the *conferva*.

* *minuta.* Brown; thorax wrinkled, and of the colour of brass; elytra pale. 4. To be found in England, in stagnant waters; very similar to the *aquatica*, but only the third part of its size.

* * *Lip cylindrical.*

* *bipustata.* Oval, black; elytra marked with a red dot. 5. It is a native of Europe; and feeds on animal substances.

* *discoidea.* Black; elytra of a dusky colour at the point. 16. Native of England.

30 species of this genus have been described in the last edition of the System of Nature.

13. Opatrum.

Antennæ moniliform, thicker towards the outside. Elytra marginated. Head prominent. Thorax somewhat flat, and marginated.

griseum. Of an ash-colour; thorax flat, and marginated; elytra marked with three elevated lines, and dentated behind. 1. Native of Italy, larger than the *fabulosum*.

* *fabulosum.* Brown; thorax emarginated; elytra marked with three elevated lines, and dentated. 2. Native of Europe and North America, in sandy plains.

monilicorne Brown; thorax and elytra hairy. 16. Native of Europe; not quite half an inch in length.

testaceum. Of a light brown colour; eyes, thorax, elytra, and antennæ dark brown. The base and tips of the latter are reddish; the elytra marked at the base with a large brick-coloured spot, resembling a crescent; the thorax impressed with two dots.

22 species of this genus have been described in the last edition of the System of Nature.

14. Tritoma.

Antennæ clavated. Club perfoliated. Feelers, anterior pair hatchet-shaped.

* *bipustulatum.* Black; the elytra marked with a lateral scarlet line. 1. Native of England, to be met with in those species of *boletus* which grow on trees.

Smooth,

fabrum. Smooth, black; the antennæ and legs of a dark colour. 2. Native of the north of Europe, to be met with under the bark of trees. It somewhat resembles the *bipustulatum*.

Seven species of this genus are described by Gmelin in the last edition of the System of Nature.

15. Cassida.

Antennæ moniliform. Elytra marginated. Head concealed under the shield of the thorax.

viridis. Green. 1. Native of Europe; frequently met with on thistles, and on a variety of plants. The larva is depressed, and furnished with six feet; it is armed with acute lateral prickles, and has a tail formed of two bristles. It walks about covered with its own excrement.

murraca. Black, with a red shield; the elytra of a blood-colour, sprinkled with black dots. 2. Native of Europe; to be met with on different kinds of plants.

nobilis. Gray; the elytra marked with a very bright blue line. 4. Native of Europe; to be met with on thistles and various plants. The bright blue line on its elytra disappears when it dies, but reappears on its immersion into warm water.

æstuosa. Black; elytra reddish yellow, spotted with black. 52. Native of Europe, but rare. It is to be met with on the white poplar, is about the same size with the *nobilis*, and, like it, loses its bright colour along with its life.

jamaicensis Of a bright glossy yellow colour; the elytra, without spots, are marked with small concave dots. 21. Native of America. At the anterior part of the future, there is a prominence forming a bunch on its back. It loses its colour in spirits of wine, and recovers it again on being immersed into warm water.

superba. Black; elytra and shield dotted, and of a golden green colour; antennæ, abdomen, and legs green. 39. Native of Europe. It loses its golden colour at the same time with its life.

This genus contains 77 species.

16. Coccinella, *Lady-bird.*

Antennæ clavated. Club solid. Feelers, the anterior pair hatchet-shaped; the posterior filiform. Body hemispherical. Thorax and elytra marginated. Abdomen flat.

* *The Elytra red or yellow; marked with black dots.*

marginata. The elytra yellow, without spots, with a black margin; the margin of the thorax marked with two white dots. Sometimes the elytra are red, with a black edge; the margin of the thorax marked with a white dot on each side. 1. Native of America, of a middling size.

immaculata. Elytra yellow, without spots; thorax marked with a black spot, and two white dots. 155. Native of Europe.

* *bipunctata.* Elytra red, marked with two black dots. 7. Native of Europe; frequent in gardens and woods; feeding on *aphides*.

* *quadripunctata.* Elytra yellow, marked with four black dots. 9. Native of Europe. Of a middle size; black below; thorax yellow, with four black dots; feet yellow.

* *quinquepunctata.* Elytra of a blood colour, marked with five black dots. 11. Native of Europe; to be met with on trees.

Elytra red, marked with seven black dots. 15. Native of Europe. The dots on the elytra are placed in the form of a triangle. This insect, as well as some others of the coleopteræ, is said to possess the property of giving immediate and effectual relief in the most violent paroxysms of the toothache, by rubbing them between the finger and thumb, and applying the finger to the affected tooth. * *septempunctata.*

Lady-cow. Elytra red, marked with six black spots; the four anterior ones transverse and arched. 68. It is a native of India. Head whitish; thorax white before with a black spot, black behind; future red; body pale yellowish. * *sexmaculata.*

The elytra yellow; with 12 black dots and a black band in the middle. 86. It is a native of the Cape of Good Hope; of a middle size. *variegata.*

The elytra tawny, with a great number of black dots, many of them running together. 118. It is a native of India, about three quarters of an inch long. *centumpunctata.*

* * *The Elytra red or yellow, marked with white.*

The elytra red; marked with 14 white, and three black dots. 32. A native of Europe; differing perhaps, only in sex, from the *decempustulata*. *punctatoguttata.*

Elytra yellow, marked with 15 white spots; the middle one, common to both elytra, almost effaced. 127. A native of Europe. *quindecemguttata.*

Elytra yellow; marked with 16 white spots. 35. Native of Europe. *sedecemguttata.*

* * * *Elytra black, marked with red.*

Elytra black, without dots, but marked with red at the points. 129. It is a native of Europe, very like the *hæmorrhoidalis*, but only half its size. *analis.*

Elytra black, their points red, marked with a black band. 130. It is a native of Germany. It is frequently marked on the back with a red dot common to both elytra. *hæmorrhoidalis.*

Elytra black, marked with two red spots. 41. It is a native of America; on the *cactus*, and is frequently gathered along with the cochineal insect. It is very similar to the *bipustulata*, which is common in Europe. *cacti.*

Elytra black, marked with two red spots; abdomen of a blood-red colour. 42. It is a native of Europe, common in gardens. Each of the spots on the elytra is composed of three spots uniting into one. * *bipustulata.*

* * * * *Elytra black, spotted with white or yellow.*

Elytra black, marked with eight yellow dots. 48. Native of the north of Europe. *pantherina.*

Elytra black, marked with eight yellow dots, the two anterior ones hooked. 146. A native of Europe. *humeralis.*

163 species of this genus have been described by Gmelin.

17. Alurnus, *Rove-beetle.*

Antennæ filiform. Feelers, six; short. Jaw, horny; arched.

Black; thorax scarlet; elytra yellow. 1. It is a native of America and India. Antennæ black, half as long as the body; thorax a little rough, pointed on each side at the base; the hind margin black; scutellum rounded, black; elytra larger and longer than the body. *grossus.*

Yellowish.

femoratus. Yellowiſh green, with a metallic luſtre; the thighs and ſhanks of the hind-legs dentated. 2. It is a native of India. It is large, ſmooth, and ſhining; the antennæ are half as long as the body; the extreme articulations are black.

dentipes. Black; the thighs and ſhanks of the hind-legs dentated. 3. Native of the Cape of Good Hope. It is ſmooth, without ſpots, and very ſimilar to the *al. femoratus.*

There have been only three ſpecies of this genus deſcribed.

18. Chrysomela.

Antennæ moniliform. Feelers ſix, growing thicker towards their exterior ſides. Thorax marginated; elytra not marginated. Body (in moſt of the ſpecies) oval.

This numerous and beautiful tribe is found everywhere, in woods and gardens. Their motion is ſlow, and ſome of them when caught, emit an oily fluid of a diſagreeable ſmell. The larvæ of this and the next family feed on the leaves of trees and plants, the fibres and cuticle of which they leave, contenting themſelves with the pulp.

* *Thighs of the Hind-legs equal.*

** tenebrioides.* Without wings, black; antennæ and legs of a violet colour. 1. It is a native of the ſouth of Europe. The larva has a bunch on its back, of a violet colour, with a red anus; it feeds on a variety of vegetables.

** gottingenſis.* Black; the legs of a violet colour. 4. It is a native of Europe, very rare in England.

vittata. The elytra blue, with a yellow edge, and marked with a yellow ſtripe in the middle. 3. It is a native of America; very large.

luſitanica. Thorax of a copper colour; elytra reſembling braſs; impreſſed with bluiſh dots, of a violet-colour underneath. 74. Native of Portugal.

** bankſii.* Of a braſs colour above, and of a brick colour below. 76. Native of Italy and Portugal, ſmaller than the preceding ſpecies. Very rare in England.

hæmorrhoidalis. Black, ſhining; antennæ yellow at the baſe; anus red above. 6. Native of Europe, on the birch and alder. The elytra are marked with regular lines of dots.

** graminis* Greeniſh-blue, very ſhining; the antennæ and legs of the ſame colour. 7. Native of Europe, on different plants, eſpecially on graſs.

** ænea.* Green, ſhining; the extremity of the abdomen reddiſh. 8. Native of Europe; on the alder.

** hæmoptera.* Of a violet-colour; feet and wings red. 11. Native of Europe.

centaurei. Of a bright copper-colour; beneath green and gold; the legs of a bright copper colour. 102. Native of Europe, on the *centaureus.* It exhibits ſome variety, eſpecially in ſize.

melanoſtoma. Oblong, black; head red, the mouth and a ſpot on the back part of the head black; the thorax red, with a black ſpot on each ſide; the elytra red, with a black ſuture. 254. Native of Europe.

polita. Thorax gilt; elytra reddiſh. 27. Native of Europe; to be met with on the poplar and willow.

cruentata. Black; the elytra ſmooth; marked with red waved croſs bands, and with ſpots of the ſame colour. 182. Native of South America.

** anglica.* Blackiſh-blue; the elytra blackiſh-yellow, marked with dots arranged in ſtraight lines; wings red. 187. Native of England.

* * *The Thighs of the Hind-legs thickened, and formed for leaping.* Alticæ.

** oleracea* Of a greeniſh-blue. 51. Native of Europe. It feeds on different kinds of plants, particularly on thoſe of the claſs *tetradynamia.* This is the little inſect which is ſo troubleſome in fields and gardens, commonly called *turnip-fly.* It attacks turnips, raddiſhes, and cabbages, when newly ſprung above ground, and conſumes their ſeminal leaves. It frequently deſtroys whole fields of turnips, ſo completely, as to render a ſecond ſowing neceſſary, which goes like the firſt. The attempts may be repeated with ſimilar ſucceſs, till the ſeaſon for ſowing be loſt.

chryſocephala. Blackiſh blue, the head and four fore-legs yellow. 53. Native of Europe.

hyoſcyami. Greeniſh blue; the legs teſtaceous; the thighs of the hind-legs of a violet-colour. 54. Native of Europe; on the henbane, turnip, and cabbage.

** quadripuſtulata.* Black; the elytra marked with four reddiſh ſpots. 217. Native of England and France, in gardens.

** anglicana.* Black; the elytra and lower part of the legs pale. 218. Native of England, on various ſorts of vegetables.

** nigripes.* Greeniſh yellow, with a metallic luſtre; legs black. 220. Native of England.

** fuſcipes.* Of a violet-colour; head and thorax reddiſh; legs black. 224. Native of Britain, on plants of various ſorts.

** teſtacea.* Teſtaceous, hunch-backed; elytra very ſmooth. 225. Native of England, on different kinds of vegetables.

cruciferarum. Blackiſh yellow; oblong, with black legs. 246. Native of Europe, on *tetradynamious* plants.

270 ſpecies of this genus have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature.

19. Cryptocephalus.

Antennæ filiform. Feelers four. Thorax marginated. Elytra not marginated. Body nearly cylindrical.

* *Feelers equal, filiform.*

† *Jaw furniſhed with one tooth.*

a. *Lip entire, Body cylindrical.*

longipes. Duſky black; the elytra pale, marked with three black blotches; fore-legs very long. 1. Native of Europe, on the hazel and willow.

** quadripunctatus.* Black; the elytra red, marked with two black dots; the antennæ ſhort and ſerrated. 3. Native of Europe, very common on the hazel. The larva is contained in a rough bag; which, on the fore-part, is terminated obliquely and abruptly.

longimanus. Of an obſcure braſs colour; the elytra of a brick colour, with a black ſpot at the baſe. 19. Native of Europe; feeds on the *trifolium montanum,* and the *euphorbia cypariſſia;* the fore-legs are very long; the larva is enclоſed in a bag.

cordiger. Thorax variegated; elytra reddiſh, marked with two black dots. 25. Native of Europe, on the hazel and willow.

willow. The ſpot on the middle of the thorax is ſometimes of the ſhape of a heart.

*vitis. Black; ſmooth; elytra reddiſh. 27. Native of the ſouth of Europe; on the vine, committing ſometimes great havock.

*coryli. Black; thorax and elytra reddiſh brown, without ſpots. 28. Native of Europe; on the hazel.

b. *Lip bifid; Body oblong.* Ciſtelæ.

*gigas. Hairy, brown; elytra, abdomen, and thighs of a brick colour. 91. Native of the ſouth of France; very large.

**cervinus.* Livid; with brown legs. 92. Native of the north of Europe.

*rufitarſis. Black; thorax ſquare; elytra ſtriated and of a brick colour. 96. Native of the ſouth of Europe; on the ears of rye.

**ſulphureus.* Yellow; the elytra of a ſulphur colour. 98. Native of Europe. Feeds on *umbelliferous* plants.

**murinus.* Black; the elytra and legs reddiſh brown. 103. Native of the north of Europe.

**anguſtatus.* Thorax and elytra of a dark reddiſh colour, black in the middle. 106. Native of Britain; ſomewhat reſembling the *murinus*, but narrower.

**pallidus.* Pale; the head, and tips of the elytra, brown. 107. Native of Britain.

†† *Jaw bifid, Body oblong.* Criocerides..

*lineola. Gray; the thorax marked with a line behind; the elytra with a black dot at their baſe. 124. Native of Italy.

*nymphæ. Brown; the margin of the elytra a little prominent and yellow, 125. Native of Europe, on the water-lily.

*tenellus. Of a ruſty colour, the edge of the thorax and elytra yellow. 133. Native of Europe, on the willow.

**cantharoides.* Of a violet colour; head, thorax and legs reddiſh. 139. Native of Britain.

**cyanella.* Blue; thorax cylindrical; prominent on the ſides. 161. Native of Britain.

*melanopus. Blue; thorax and legs reddiſh. 162. Native of Europe. Feeds on the oak.

**ſubſpinoſus.* Black; head and thorax ſomewhat prickly; feet reddiſh. 164. Native of Britain.

**aſparagi.* Thorax red, marked with two black dots; elytra yellow; marked with a black croſs, and four black dots. 167. Native of Europe, feeding on aſparagus. There are two or three varieties of this ſpecies. β. With two ſpots on the elytra connected at the baſe, is to be met with in Italy. γ. With two narrow red bands on the elytra, is to be met with in France.

**phellandrii.* Black; the edge of the thorax and two lines on the elytra yellow. 168. Native of Europe; to be found at the roots of the *phellandrium aquaticum*.

** *Feelers unequal, the anterior ones hatchet-ſhaped.*

† *The Lip of a ſubſtance like horn.* Erotyli.

*giganteus. Oval, black; the elytra marked with a great many tawny dots. 191. Native of India.

*venereus. Black; the thorax and elytra of a bright copper colour. 205. Native of New Holland.

†† *The Lip membranaceous.* Lagriæ.

*elongatus. Black; the thorax red and hairy. 221. Native of Europe, particularly of England.

**glabratus.* Smooth; thorax reddiſh; elytra yellow. 230. Native of England.

268 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

20. Hispa, *Bluſſom-eater.*

Antennæ cylindrical; approaching one another at the baſe, and placed between the eyes. Feelers ſpindle-ſhaped. Thorax and elytra frequently prickly.

**atra.* Body entirely black; antennæ ſpindle-ſhaped; thorax and elytra prickly. 1. Native of the ſouth of Europe and north of Africa. To be found at the roots of graſs.

**mutica.* Without prickles; the antennæ hairy. 4. Native of Europe; in rubbiſh and in muſeums.

**cornigera.* Antennæ ſerrated; thorax red; elytra blue; head furniſhed with two horns. 15. Native of Britain.

**ſlabellicornis.* Black; the antennæ pectinated; the elytra ſtripped. 19. Native of England.

20 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

21. Bruchus, *Glutton.*

Antennæ filiform. Feelers equal and filiform. Lip pointed.

**piſi* The elytra black, ſpotted with white; the anus white, with two black ſpots. 1. Native of North America. It has been lately introduced into Europe, where it commits great havock in the fields of peas. It is alſo very deſtructive to orchards when in bloom.

*robiniæ. Gray, ſomewhat ſhining; the elytra very little ſhorter than the abdomen. 9. Large; and has been introduced into Europe, along with the ſeeds of the *robinia pſeudacacia* from America.

**ſcabroſus.* Black; the elytra red, marked with raiſed ſtripes. 11. Native of Europe, chiefly on the horſe-cheſnut.

*cacao. Body brown, ſpotted with gray. 13. It feeds on the ſeeds of the *theobroma*.

*theobromatis. The elytra gray; ſpotted with black; legs red; ſcutellum white. 2. Feeds on the ſeeds of the *theobroma*.

*bipunctatus. Aſh coloured; elytra brown; with a black dot at the baſe; ſurrounded by a yellow circle. 17. Native of Switzerland, on different plants.

**granarius.* Elytra black; ſpeckled with white; the thighs of the hind-legs are marked with a ſingle projection reſembling a little tooth. 5. Native of Europe. Feeds on the ſeeds of various plants.

**ſeminarius.* Black; the baſe of the antennæ and fore feet reddiſh brown; thighs ſmooth. 6. Native of Europe, on flowers; very ſmall.

25 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

22. Pausus.

Antennæ conſiſting of two articulations, clavated. Club ſolid and hooked.

I 2

macrocephalus. 1. It is a native of North America; entirely black, the head very ſmall, the thorax narrow, with an elevated tranſverſe margin on the fore-part; the elytra terminated abruptly by a tranſverſe line, and a little longer than the abdomen; which is likewiſe terminated abruptly. It is about the ſize of the *dermeſtes lardarius*.

23. Zygia.

Antennæ moniliform. Feelers unequal, filiform. Lip elongated, membranaceous. Jaw furniſhed with one tooth.

oblonga. Oblong, reddiſh; head and elytra of an obſcure blue. 1. Native of the eaſt.

24. Zonitis.

Antennæ ſetaceous. Feelers four, filiform; ſhorter than the jaw, which is entire. Lip emarginated.

chryſomelina. Yellow; the elytra marked with a black dot in the middle and at the baſe. 1. Native of Egypt. Black below; the extremity of the abdomen reddiſh.

flava. Reddiſh; the elytra yellow and black at the tip. 2. Native of the eaſt.

25. Apalus.

Antennæ filiform. Feelers equal; filiform. Jaw horny; furniſhed with one tooth. Lip membranaceous; terminating abruptly, and entire.

bimaculatus. Furniſhed with wings; black, the elytra yellow, marked with a black dot behind: formerly *meloë bimaculatus*. Native of the north of Europe; to be ſeen early in the ſpring, in ſandy places.

26. Brentus.

Antennæ moniliform, advancing beyond the middle of the ſnout. Mouth furniſhed with a ſtraight, cylindrical ſnout, which projects conſiderably.

* *Thighs ſimple.*

barbicornis. Cylindrical; ſnout very long, bearded beneath; the elytra lengthened out and elevated. 1. Native of New Zealand. Snout longer than the body; antennæ ſhorter than the ſnout, placed near the tip; eyes globular, black; thorax cylindrical, black with gray hairs; elytra ſtreaked and dotted, with furrowed ſpots; legs black, with gray hairs.

* * *Thighs dentated.*

anchorago. Linear; the elytra ſtriped with yellow: thorax lengthened. Native of South America and India.

This genus includes 11 ſpecies.

27. Curculio, *Diamond-beetle.*

Antennæ clavated, placed upon the ſnout, which is formed of a horny ſubſtance, and prominent. Feelers four, filiform.

This beautiful and numerous genus is divided into five ſubdiviſions: their larvæ have a ſcaly head, and ſix ſcaly legs. Thoſe of the long-ſnouted ones are moſt deſtructive in granaries, and to ſeeds of almoſt every deſcription. They inſinuate themſelves into the grain, and conſume it gradually, leaving nothing but the ſkin, in which they lie concealed, and undergo their metamorphoſis. Thoſe with the ſhort ſnout infeſt artichokes, and the ſtalks and leaves of plants. The leaves of many trees, particularly the elm, may be ſeen marked with yellow ſpots, occaſioned by the larvæ of this tribe inſinuating themſelves within the cuticle of the leaf, and forming a bag, in which they lurk, till they come forth a perfect inſect.

* *Long-ſnouted.*

† *Thighs ſimple.*

gigas. The thorax and elytra rough. Antennæ white at the tips. Native of Japan. Snout cylindrical, long, arched, brown on the fore part, of an aſh-colour behind; thorax rounded, brown, rough, with raiſed ſharp points; elytra rough, gray, with ſcattered brown and white dots.

brachypteros. Black; thorax flat and dotted, with a line ſlightly elevated; elytra ſhortened and ſomewhat ſtripped: the intervals dotted. 555. Native of Europe.

undatus. Black; the elytra marked with white dots ſet in regular rows, and with white interrupted waved bands. 556. Native of Europe.

coccineus. Scarlet; the elytra marked with ten rows of dots. 558. Native of Europe.

cyaneus. Black; the elytra of a violet colour; the ſcutellum white. 5. Native of Europe, particularly on the willow.

craccæ. Black above; aſh-coloured below, and hunch-backed. 6. Native of Europe; feeds on the ſeeds of the vetch; it is very ſmall.

* *malvæ.* Gray; the elytra and legs reddiſh brown. 101. Native of England, on the mallow. The ſnout and abdomen black.

roboris. The ſnout and thorax red; the elytra of a violet colour. 103. Native of Europe, on the oak.

acridulus. Black; with the abdomen oval. 13. Native of the north of Europe, frequently to be met with on plants of the claſs *tetradynamia*.

frumentarius. Of a blood-colour. 15. Native of Europe, and very deſtructive to corn which has been long kept.

oryzæ. Black; the thorax dotted, and of the ſame length with the elytra; the elytra marked with two red ſpots. This ſpecies is very deſtructive to rice kept in granaries.

* *granarius.* *Weevil* or *Bond.* Black; the thorax dotted, and of the ſame length with the elytra. 16. This deſtructive little animal does much miſchief in granaries, and in biſcuit kept in ware-houſes, or on ſhip-board. Woad, henbane, and elder, are ſaid to drive them away from grain which has been infeſted by them, and, on that account, is ſometimes mixed with the grain.

* *pini.* The elytra of a brick colour, with cloudy bands. 19. Native of Europe; in the bark of the *pinus ſylveſtris*.

cyaræ. Black, ſprinkled with green: ſnout black and bent, ſomewhat reſembling a keel. 121. Native of Africa, and the ſouth of Europe: on the flowers of the artichoke.

* *paraplectus.* Cylindrical and aſh-coloured; the elytra ſet with ſharp

ſharp points. 34. Native of Europe; on umbelliferous plants, particularly on the *phellandrum aquaticum*; in the ſtalks of which the larva is frequently lodged, and is ſuppoſed to be the cauſe of the ſtaggers in horſes.

bardanæ. Cylindrical; covered with a gray down; the fore-legs long. 152. Native of Europe, on the *burdock*. When old, it loſes the gray down, and becomes ſmooth and black.

bacchus. Of a bright copper-colour; ſnout and feet black. 38. Native of the ſouth of Europe, on the vine and hazel. Somewhat hairy above.

frugilegus. Oblong; of a cheſnut colour; the elytra equalling the thorax, marked with four red ſpots. Native of South America and India. It is ſmall, and very deſtructive to grain.

†† *Hind thighs thickened.* Saltatorii.

* *quercus.* Pale yellow; eyes black. 25. Native of Europe; on the willow, elm, and oak, the leaves of which it frequently covers with blotches, by inſinuating itſelf within the cuticle. It is about the ſize of the *pediculus humanus*.

fegetis. Body black; elytra oblong. 45. Native of Europe; on the ears of corn.

††† *Thighs dentated.*

aterrimus. Black; the elytra ſhining. 10. Native of Europe; very frequent on plants of different kinds.

* *ceraſi.* Black; the elytra opaque and oblong. 11. Native of Europe; on the leaves of the cherry and pear-tree, the cuticle of which it eats.

* *pomorum* The thighs of the fore-legs dentated; body gray, clouded. 46. Native of Europe, on the flowers of fruit-trees.

* *caliginoſus.* The ſtreaks of the elytra approaching one another, and dotted. 243. Native of Britain, but rare. Body oblong, entirely black, opaque; thorax rounded and punctured; elytra with deep approximate ſtriæ in pairs; thighs ſharply dentated.

* *germanus.* Black; the thorax marked with two reddiſh dots on each ſide. 58. Native of Europe; very common in Germany. It is amongſt the largeſt of this genus that is to be met with in Europe.

* *nucum.* Body gray, of the ſame length with the ſnout. 59. Native of Europe; frequently to be found in hazel-nuts.

* *ſcrophulariæ.* The elytra marked with two black ſpots ſituated near the future. 61. Native of Europe; on the figwort, the capſules of which the larvæ conſume, and ſubſtitute in their place brown follicles.

* * *Breviroſtres.*

† *Thighs dentated.*

ſpectabilis. The body variegated with green and black. 298. Native of New Holland.

fuſco-maculatus. Black; the thighs faintly dentated; the thorax and elytra ſmooth, ſpotted with brown. 301. Native of Europe; large, ſmooth.

ovatus. The abdomen oval and black; the legs and antennæ reddiſh. 69. Native of Europe; in orchards.

* *pyri.* Yellowiſh-brown. 72. Native of Europe. The larva feeds on the leaves of the pear-tree; the perfect inſect on the flowers of the pear and of the plumb. The colour varies; ſometimes it is bronzed, red, green, &c.; legs reddiſh; body covered with oblong ſcales of various colours; elytra ſtriated, punctured.

Downy, brown; the thighs acutely dentated; antennæ and legs browniſh. 308. Native of Europe; on the apple-tree. * *malæ.*

†† *Thighs ſmooth.*

The thorax marked with lines; the elytra of an aſh-colour, marked with little brown lines; the future brown, dotted with black. 26. Native of Europe; on the *polygonum*. *polygoni.*

Above, browniſh-gray; beneath, aſh-coloured; ſnout grooved. 335. Native of Britain. * *griſeus.*

Blackiſh; the elytra gray, marked with two white ſpots, and with a larger one behind, which is common to both elytra. 336. Native of Britain. * *triguttatus.*

The elytra marked with black elevated ſtripes, and with bright green and gold dotted furrows alternately, ſwelling out at their baſe, and drawing to a point at their tips. 349. Native of South America. It is very large, and the moſt beautiful inſect hitherto known; commonly known by the name of the diamond-beetle. *imperialis.*

Body green, ſilky, ſtriped with broad gold bands. 75. Native of South America. The thighs brown, marked with a golden ring. *regalis.*

Oblong, brown; the back part of the thorax flat. 81. Native of Europe; common in fir. * *incanus.*

616 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

28. Rhinomacer.

Antennæ ſetaceous, placed upon the ſnout. Feelers four, thicker towards their exterior ſide.

Covered with gray down; antennæ and legs black. 1. Native of Italy. *curculioides.*

Covered with black hair; antennæ and legs reddiſh. 2. Native of Europe; in pine-foreſts. *attelaboides.*

Blue, ſomewhat hairy; baſe of the antennæ and the legs yellow. 3. Native of Europe. *cæruleus.*

Only three ſpecies of this genus have been deſcribed.

29. Attelabus.

Head drawn to a point on the hind part, and inclined. Antennæ moniliform, the articulations towards the point thicker than the reſt.

* *Jaw biſid.*

Black, the elytra red and reticulated. 1. Native of Europe; on the leaves of the hazel, which it rolls up into cylinders and ſhuts up at both ends. * *coryli.*

Black; legs formed for leaping. 7. Native of Europe; on the leaves of the birch, which it renders beautifully curled by its gnawing. It leaps very nimbly. * *betulæ.*

* * *Jaw furniſhed with one tooth.*

† *The poſterior feelers hatchet-ſhaped.* Cleri.

Black; the elytra marked with three white bands, and red at the baſe. 19. Native of Europe. *mutillarius.*

Black; thorax reddiſh; elytra red, white at the baſe, and * *formicarius.*

and marked with two white bands. 8. Native of Europe: it deſtroys the *ptinus pertinax* and many other inſects.

* *apiarius.* Bluiſh; the elytra red, marked with three black bands. 10. Native of Europe and America. The larva is frequently to be met with in bee-hives, the perfect inſect on flowers. It is double the ſize of the *formicarius*.

†† *Feelers four, nearly filiform.* Spondilides.

ceramboides. Black; the elytra full of wrinkles, and broader than the thorax. 12. Native of Europe, in the *boletus fomentarius*.

buprestoides. Black; the elytra very much ribbed; the thorax almoſt globular. 13. Native of Europe, in woods.

There are 34 ſpecies of this genus.

30. Notoxus.

Antennæ filiform. Feelers four, hatchet-ſhaped. Jaw furniſhed with one tooth.

* *mollis.* Downy; the elytra black, marked with three pale bands. 3. Native of Europe; on flowers.

* *monoceros.* Thorax projecting over the head like a horn; elytra pale, marked with a black band and dot. 4. Native of Europe, on umbelliferous plants.

There are four ſpecies of this genus.

31. Cerambyx.

Antennæ ſetaceous. Feelers four. Thorax prickly or turgid. Elytra linear.

This is a very beautiful and finely variegated family. The larvæ reſemble ſoft, oblong, ſlender worms, with a ſcaly head and hard legs on the fore-part. They bore through the inner part of trees, pulveriſing the wood, and are transformed into perfect inſects in the cavities they make. Many of them diffuſe a ſtrong ſmell, perceivable at a great diſtance; and ſome, when taken, utter a ſort of cry, produced by the friction of the thorax on the upper part of the abdomen and elytra.

* *Feelers four, equal.*

a. *Filiform.*

† *Jaw cylindrical, entire.* Prioni.

a. *The Thorax furniſhed with moveable ſpines.*

trochlearis The elytra variegated with a dark colour and white, with raiſed dots. 2. Native of India.

longimanus. The elytra marked with a ſmall projection at their baſe, and with two at the tip; the antennæ long. 1. Native of South America. The ſhanks of the fore-legs, in the male, are very long.

b. *Thorax marginated.*

cervicornis The thorax with three little projections on each ſide; the jaws ſtretched out, and furniſhed with one ſpine on their outſide; the antennæ ſhort. 3. Native of America. The larva is found in the wood of the *bombax*. It is eatable, and reckoned a delicacy by the natives.

armillatus. The thorax furniſhed with four ſmall projections on each ſide; the elytra ruſty-coloured, edged with black; the thighs of the hind-legs marked with a little projection. 4. Native of India; very large.

damicornis Thorax furniſhed with very ſmall projections; the jaws ſtretching out, and furniſhed with two teeth; the antennæ ſhort. 86. Native of South America. The larva is eaten by the natives, and much reliſhed.

faber. The thorax wrinkly and marked on each ſide with a ſmall projection; the elytra black; the antennæ of a middling length. 6. Native of Europe; in wood.

* *coriarius* Thorax marked with three ſmall projections; body black; the elytra furniſhed with ſharp points; antennæ ſhorter than the body. 7. Native of Europe; on decayed birch-trees. It produces large, oblong, yellowiſh eggs.

†† *Jaw obtuſe, furniſhed with one tooth.* Cerambyces.

nebuloſus. Thorax prickly; elytra formed like the roof of a houſe, marked with black bands and dots; the antennæ longer than the body. 29. Native of Europe; in the ſtems of fir-trees, which it kills by conſuming the inner bark.

faſciculatus. Thorax prickly; elytra entire, marked with three prickly dots; the antennæ of the ſame length with the body. 106. Native of Europe.

* *biſpidus.* Thorax prickly; elytra whitiſh at their anterior part, and furniſhed with two ſmall projections at their tips; the antennæ of the ſame length with the body, and rough. 30. Native of Europe.

* *moſchatus.* Green ſhining; thorax prickly; antennæ blue, and of the ſame length with the body. 34. Native of Europe; on the willow. The colour of the antennæ and legs varies from a blue to brown. The living inſect has a ſmell of muſk, which is ſaid to have a ſoporific effect. It produces white eggs. The green colour of this inſect is ſometimes tinged with blue, and at other times it is entirely blue and gold. The ſmell it diffuſes, is imagined by ſome to reſemble the ſmell of a roſe, and frequently pervades a whole meadow, where the inſect happens to be plentiful.

heros. Black; the thorax prickly and wrinkled; the elytra ſomewhat prickly and reddiſh brown: antennæ long. 128. Native of Europe; on the oak.

††† *Jaw divided.*

* *Horny.* Lamiæ.

futor. Thorax prickly; elytra black, with ruſty-coloured ſpots; ſcutellum yellow; antennæ very long. 38. Native of Europe; in woods.

ſartor. Black; thorax prickly; ſcutellum bright yellow; elytra without ſpots; antennæ very long. 159. Native of Europe; larger than the preceding ſpecies.

textor. Thorax prickly; elytra black and convex; antennæ of the ſame length with the body. 41. Native of Europe; on trunks of trees.

fuliginator Black; thorax ſomewhat prickly; elytra aſh-coloured; antennæ ſhort. 43. Native of Europe. When old, it becomes entirely black. It is met with in wool, after it has been cut from the ſheep.

regalis. Thorax prickly, and marked with green bands; the elytra ſprinkled with green, with three tawny ſpots. 167. Native of Africa. Antennæ longer than the body, black; head beneath lined with green; a tawny ſpot under

under the eyes; thorax black, with three impreſſed green bands; elytra ſomewhat ſtriated; black ſprinkled with green; abdomen with a white line of tawny dots on each ſide.

** *Membranaceous.* Saperdæ.

carcharias Thorax ſmooth, cylindrical; body gray, dotted with black; antennæ of the ſame length with the body. 52. Native of Europe.

cardui. Of a duſky colour; thorax marked with lines; ſcutellum yellow; antennæ long. 56. Native of Europe; on thiſtles, injuring them much in the month of May. Body brown, ſpeckled with yellow; thorax marked with three yellow lines.

* *populneus.* Thorax without ſpines, cylindrical, yellow, and marked with lines; elytra marked with four yellow dots; antennæ of the ſame length with the body. 57. Native of Europe; on the poplar. Body brown; antennæ variegated with black and white.

* *cylindricus.* Cylindrical black; fore-legs yellow. 5. Native of Europe; on the pear and plum-tree.

β. *Feelers capitated.* Rhagia.

curſor. Thorax prickly; elytra obtuſe and reddiſh, marked with a black line, and black along the future; antennæ of the ſame length with the body. 45. Native of Europe.

* *anglicus.* Thorax prickly; elytra marked with two oblique yellow bands. 237. Native of Britain.

inquiſitor. Black; thorax prickly; elytra clouded with brick-coloured ſtripes; antennæ ſhorter than the body. 49. Native of Europe, on the trunks of trees. The larva has ſix feet, and is naked; white; head and collar horny, brown; back grooved.

elegans. Black; thorax with a ſpine on each ſide; elytra cheſnut-coloured; their baſe future, and a ſpot on each, are black; they are likewiſe marked with two yellow bands. 242. Native of Europe.

γ. *Feelers clavated.* Callidia.

* *ruſticus.* Thorax naked; body pale; the antennæ tapering, and ſhorter than the body. 67. Native of Europe; in woods.

luridus. Thorax naked and furniſhed with knobs, black; the elytra of a brick colour. 68. Native of Europe; in fir-woods.

* *violaceus* The thorax ſomewhat downy; body of a violet colour; antennæ ſhorter than the body. 70. Native of Europe; chiefly in fir-timber, which has been cut down ſome time, and which has not been ſtripped of its bark. It bores ſerpentine cavities between the bark and the wood, which are larger in diameter as the inſect increaſes in ſize, filling the ſpace it leaves behind with its excrement, which reſembles ſaw-duſt. Body dark violet, a little hairy; antennæ hardly as long as the body, hairy; ſternum with a ſmall projecting point; elytra linear, rounded at the tip, turgid at the baſe. It varies in having the head and thorax, and even the body, greeniſh.

* *bajulus.* Thorax hairy, marked with two protuberances; body brown. 76. Native of Europe, on the trunks of trees, in timber, in houſes, perforating the joiſts, particularly thoſe that have been formed of fir-timber.

** *Feelers unequal; the anterior pair filiform, the poſterior clavated.* Stenocori Fabricii.

Thorax ſlightly prickly; elytra formed like the roof of a houſe; the anterior part of them reddiſh brown; the breaſt ſhining. 47. Native of Europe. Male of a brick colour, female blackiſh; larva lives under ground, and has very long legs. * *meridianus.*

379 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

32. Calopus.

Antennæ filiform. Feelers four; the anterior ones clavated; the poſterior filiform. Thorax turgid. Elytra narrow, and of an equal breadth throughout their whole length.

Brown; the antennæ compreſſed. 1. A native of Europe; it is long, and cylindrical. * *ſerraticornis.*

Very ſmall, brown; the antennæ ſerrated and hairy. 3. A native of Europe; about the ſize of a flea. *pygmæus.*

There are three ſpecies deſcribed in the laſt edition of the Syſtem of Nature.

33. Leptura.

Antennæ ſetaceous. Feelers four, filiform. Elytra growing ſmaller towards the tip. Thorax ſomewhat tapering.

* *Lip entire.* Donacia of Fabricius.

Of a golden colour; the thighs of the hind legs clavated and notched. 1. A native of Europe; on aquatic plants, on the water-lily, *phellandrum aquaticum*, at the roots of which the pupa may be found enclоſed in brown globes. The thighs of the hind-legs are ſometimes without notches. Antennæ blackiſh, the joints pale, reddiſh at the tip; head with a little down on the middle; thorax grooved; elytra ſtreaked, dotted, and terminating abruptly, with ſhort appendages at each margin; body beneath downy; legs dull, browniſh red. * *aquatica.*

Of a golden colour; the thighs ſimple. 17. A native of Britain; on aquatic plants. * *ſimplex.*

Shining green golden colour; the elytra marked with dotted ſtreaks and with crenated wrinkles, likewiſe with a bright purple and green fillet; the abdomen, antennæ, and legs, of a golden colour; the thighs of the hind-legs notched. 88. A native of Europe. *nitida.*

Silvery green; the elytra marked with dotted ſtreaks, crenated wrinkles, with a broad green and purple fillet common to both elytra; the head, abdomen, and legs, of a golden colour; the thighs of the hind-legs without notches. 89. A native of Europe. *vulgaris.*

** *Lip bifid.* Lepturæ.

A. *The Thorax on the fore part ſomewhat oblong and narrow.*

Black; the elytra reddiſh, with a black dot in the middle. 22. A native of Europe. *unipunctata.*

Black; elytra red, black at the tips and at the future. 23. A native of Europe. The abdomen is reddiſh in the male, which is ſmaller than the female. *baſſata.*

melanura. Black; the clytra reddiſh or livid, black at the tips and at the future. 2. A native of Europe; the elytra are black at the tips in the male, in the female they are all of one colour.

* *rubra.* Black; the thorax, the elytra, and ſhank of the legs, purple. 3. A native of Europe; on flowers.

* *villica.* Of a ruſty colour; the antennæ, clytra, and breaſt, dark brown. 28. A native of Britain.

ſplendidula. Black; covered with yellow hairs; the elytra ſmooth at the tips; the legs tawny; antennæ brown, and of a ruſty colour at the baſe. 49. A native of Europe.

rufipes. Black; the legs reddiſh; the thighs red at the baſe. 52. A native of Europe; frequently to be met with in the month of May, on the buckthorn, the dog-wood, and hawthorn.

B. *The Thorax nearly globular, and not attenuated on its anterior part; the Elytra blunt at the tips, but not truncated.*

* *virginia.* The thorax globular and black; the elytra of a reddiſh colour; the abdomen reddiſh. 15. A native of Europe.

* *collaris.* The thorax globular and red; the abdomen red; and the elytra black. 16. A native of Europe.

bipartita. Black; the thorax of a ruſty colour, marked with a longitudinal black line; the elytra marked with a ruſty-coloured ſpot, common to both of them. 71. A native of Europe.

nitens. The thorax globular, which, as well as the abdomen, is of a ſhining black, covered with a yellow down; the elytra black, marked with four broad tranſverſe yellow bands; the legs of a ruſty colour. 67. A native of America.

100 ſpecies of this genus have been deſcribed by Gmelin, in the laſt edition of the Syſtem of Nature.

34. Necydalis, *Carrion-Eater.*

Antennæ either ſetaceous or filiform. Feelers four, filiform. Elytra ſmaller, ſhorter, or narrower than the wings. Tail ſimple.

* *Antennæ ſetaceous; Elytra ſhorter than the wings or abdomen.*

* *major.* The elytra of a ruſty colour, without ſpots; the antennæ ſhorter than the body. 1. A native of Europe.

* *minor.* The elytra reddiſh brown, with a ſmall line at the top; the antennæ larger than the body. 2. A native of Europe.

* *umbellatarum.* The elytra of a brick colour, without ſpots; the antennæ long. 3. A native of Europe; on umbelliferous plants.

* * *Antennæ filiform; the Elytra growing narrower towards the tips, and of the ſame length with the abdomen.*

* *viridiſſimus.* The thorax ſomewhat tapering; body green. 13. A native of Europe; very frequent in gardens.

* *humiralis.* The elytra black, yellow at the baſe. 18. A native of Britain.

melanura. Black; the thorax and elytra reddiſh brown; the latter are black at the tips. 20. A native of Europe; on plants of different kinds.

26 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

35. Lampyris. *Fire-Fly.*

Antennæ filiform. Feelers four. Elytra flexible. Thorax flat, hemiſpherical, ſurrounding and concealing the head under it. The ſides of the abdomen furniſhed with folded papillæ. The female in moſt of the ſpecies without wings.

* *Feelers nearly clavated.*

* *noctiluca.* *Glow-worm.* Oblong, brown; ſhield aſh-coloured. 1. A native of Europe; in woods and meadows. The female is larger than the male, and emits a beautiful phoſphoric light, for the purpoſe of attracting the male. It is apparent that their ſhining light depends on a fluid placed near the extremity of the abdomen; the light becomes brighter, and of a finer green colour, when the inſect is in motion. The little animal can withdraw the light at pleaſure by contracting itſelf. Though the inſect be bruiſed, the light continues for a conſiderable time.

coruſca. Duſky black; the ſhield marked, on both ſides, with a circular roſe-coloured ſpot. 2. A native of North America.

ſplendidula Oblong, brown; the ſhield reſembling glaſs at the tip. 3. A native of Europe; in woods. This has been thought only a variety of the *noctiluca*; it is peculiarly reſplendent in ſhowery weather. The female emits the brighter light, particularly when pregnant.

pyralis. The ſhield reddiſh, and black in the middle; the elytra black, with a white edge; the abdomen white. 4. A native of the ſouth of America.

japonica. Yellow; the third ſegment of the abdomen from the anus is black. 22. A native of Japan; very plentiful in the months of May and June; diffuſing a very ſtrong light from two ſmall bags at its tail, filled with air; eyes, antennæ, and wings black.

italica. The elytra brown; the thorax tranſverſe, red. 11. A native of Italy and Switzerland; on trees; leſs than the reſt of the genus; brown; the laſt two ſegments of the abdomen yellow; the breaſt and legs pale yellow; the female black.

* * *Feelers nearly filiform.*

ſanguinea. Black; the ſides of the thorax and elytra of a blood colour. 17. A native of Europe; in ſtony ground.

pectinicornis. Black; the thorax and elytra of a brick colour; antennæ pectinated. 34. A native of Europe.

* *coccinea.* Black; the thorax and elytra of a blood colour, and without ſpots. 18. A native of Europe; in hedges; head ſometimes reddiſh, the elytra ſometimes ſtriated.

* * * *Feelers with the laſt joint thicker than the reſt, and terminating abruptly.* Lyci.

latiſſima. Yellow; elytra with a black marginal ſpot, and black behind, the lateral margin very much dilated. 14. A native of Sierra Leona. Mouth cylindrical, prominent; body narrower before, and very wide behind; antennæ ſerrated.

atra. Black; thorax orbicular, and with the elytra red, marked with an impreſſed black ſpot on the back. 44. A native of Europe.

Forty-four ſpecies.

36. Horia.

Antennæ moniliform. Feelers four, thicker towards their outer ſide. Lip linear, rounded at the tip.

teſtacea. Reddiſh; antennæ and legs black. 1. A native of Tranquebar; the hind thigh of the male thickened, and grooved beneath, and marked with a little projection.

dermeſtoides. Reddiſh brown; eyes, wings, and breaſt black. 2. A native of Europe.

There are only two ſpecies of this genus deſcribed.

37. Cucujus.

Antennæ filiform. Feelers four, equal; the laſt articulation terminating abruptly, and thicker than the reſt. Lip ſhort, biſid; the diviſions linear, and diſtant from one another. Body depreſſed.

muticus. Thorax unarmed, black, with an impreſſed dot on each ſide; elytra ſtriated, brown. 2. A native of Europe; black.

teſtaceus. Of a brick colour; thorax nearly ſquare, unarmed; thighs compreſſed. 3. A native of Europe, under the bark of the birch tree.

quadratus. Black; the thorax ſquare, notched behind, marked with tubercles in the middle, and wrinkled on the external edge, clavated on the anterior part; the antennæ brown; the legs and elytra ſimple and reddiſh. A native of Europe.

Eleven ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

38. Cantharis.

Antennæ filiform. Thorax (for the moſt part) marginated, and ſhorter than the head. Elytra flexible. Sides of the abdomen edged with folded papillæ.

* *Feelers four, hatched-ſhaped.*

This is an extremely rapacious genus, preying on other inſects, and even on its own tribe; thoſe of the diviſion *lymexylon* only, both in the grub and perfect ſtate, feed on green wood.

* *fuſca.* Thorax red, with a black ſpot; elytra brown. 2. A native of Europe; in hedges; moſt rapacious, and devouring its own ſpecies.

marginella. Reddiſh; the abdomen black and marginated; the back part of the head, eyes, and breaſt yellow. 73. A native of Europe.

media. Brown; the thorax, head, baſe of the antennæ, the ſides and tip of the abdomen, and the legs reddiſh. 14. A native of Europe.

hæmatoma. Black; mouth and abdomen red. 75. A native of Europe.

biguttata. The middle of the thorax black; the elytra ſhortened, black and yellow at the tip. 11. A native of Europe; in groves and gardens.

cardiacæ. The thorax ſomewhat marginated; body black; antennæ pectinated; the elytra marked with a blood-coloured dot at the tip. 13. A native of Europe; on the *leonurus cardiaca.*

biſtrio. Black; the thorax, the baſe of the antennæ, poſterior baſe of the ſegments of the abdomen, and legs yellow, with a brown ſpot on the thorax. 82. A native of Europe.

** *Feelers filiform, the laſt articulation ſetaceous.* Malachii.

* *ærea.* Bright greeniſh yellow; the upper ſurface of the elytra red. 7. A native of Europe; on plants. It is furniſhed with two tentacula at the baſe of the abdomen, of a blood colour, blunt, and connected at the baſe; likewiſe two on the thorax which can be ſtretched out. There is a ſmaller variety, with the elytra wholly of a blood colour.

* *bipuſtulata.* Bright yellowiſh green; the elytra red at the tips. 8. A native of Europe.

hæmeroidales. Black; the thorax and tips of the elytra red. 86. A native of Europe.

cryſomeloides. Thorax red, emarginated; elytra blue and ſmooth; antennæ and legs black. 63. A native of France; when touched under the breaſt, it contracts its head and body; when ſet at liberty it runs off very quickly.

*** *The anterior feelers ſtretched out; the laſt articulation but one, is enlarged with a large oval ſplit appendage; the laſt articulation arched, and acute.* Lymexylon.

proboſcidea. Black; the elytra light brown, and black at the tip; the feelers hooked, and irregular. 69. A native of Europe; in timber.

barbata. Brown; the antennæ and ſhanks of the legs black. 70. A native of Europe; in timber; covered with gloſſy down of a changeable hue; antennæ and legs paler.

* *navalis.* The thorax ſomewhat tapering; body yellow; the margin and tips of the elytra black. 26. A native of Europe; in the timber of the oak, to which it is very deſtructive.

Eighty-ſix ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

39. Serropalpus.

Antennæ ſetaceous. Feelers four, unequal; the anterior one longer than the reſt, and deeply ſerrated; four articulations, the laſt one very large, terminating abruptly, compreſſed, and like a plate; the poſterior ones nearly clavated. Thorax marginated, the anterior one receiving the head, with a prominent angle on each ſide. Head bent down. Legs formed for digging.

ſtriatus. Body brown; the elytra ſtriated. A native of the iſland of Runſala; found on old wooden buildings in autumn.

lævigatus. Body black; the elytra ſmooth. 2. A native of Europe.

40. Elater, *Skipper.*

Antennæ filiform. Feelers four, hatchet-ſhaped. Under ſide of the thorax terminating in an elaſtic ſpine, coming out from a cavity of the abdomen; by which means the body, when placed on the back, ſprings up and recovers its natural poſture.

Brown;

flabellicornis. Brown; antennæ with a fan-shaped tuft of eight large black leaves. 1. A native of India. This is one of the largest of the genus; the antennæ short.

noctilucus. Sides of the thorax marked with a smooth yellow spot. 4. A native of America. This insect, like the *Lampyris* and *fulgora*, affords a strong phosphoric light in the night time, the streams of which are so strong, that a person may see to read the smallest print. When placed on its back, it will spring four or five inches from the level on which it is put, to recover its natural position; the abdomen when removed from the body is luminous internally.

phosphoreus. Brown; the thorax marked on its posterior part with two smooth yellow spots. 5. A native of South America, resembling the *noctiluca* very much, but only half the size, although considerably larger than the species to be found in Europe; the spots of the thorax shine in the night like the preceding species.

bipustulata Black, shining; the elytra marked with a black dot at the base. 9. A native of Europe, on pasture grounds.

* *brunnius* The thorax reddish, and black in the middle; the elytra and body of a rusty colour. 10. A native of Europe; in gardens.

* *cruciatus* The thorax black, rusty-coloured on the sides; the elytra yellow, marked with a black cross, and black on the edges. 12. A native of Europe; on pasture grounds.

* *ruficollis* Black; the hind part of the thorax red, and shinning. 14. A native of Europe; on grass land.

mesomelos. The thorax and edge of the elytra of a rusty colour; body and elytra black. 16. A native of Europe; larva six-footed, filiform, and hardish, furnished with a horny shield at the tail, notched at the sides, and furnished beneath with a conical hollow tubercle in form of a leg on the under side. It is common in decayed wood.

* *aterrimus* Thorax black and shining; the elytra striated and black. 17. A native of Europe.

* *castaneus* The thorax reddish and downy; the elytra yellow, and black at the tip. 13. A native of Europe; in low grounds.

* *sanguineus.* Black; elytra of a blood colour. 21. A native of Europe; in grass lands. The tip of the elytra black. —A larger variety is found with the thorax downy and tawny; the elytra of a deep colour, and marked with a faint black blotch at the base.

segetis. Black; the antennæ and feet brown; the elytra marked with longitudinal black and brown lines. 114. A native of Europe; at the roots of corn. The larva destroys the fields, especially in dry seasons; it is a long time before it undergoes its metamorphosis.

funereus. Reddish; the elytra striated; head brown. 144. A native of Europe.

* *obscurus.* Of a rusty colour; head and thorax brown, the latter, together with the elytra and legs, are of a brick colour. 146. A native of Europe.

149 species of this genus have been described in the last edition of the System of Nature.

Cicindela, the *Sparkler*.

Antennæ setaceous. Feelers six, filiform; the posterior ones hairy. The jaws prominent and many-toothed. Eyes prominent. Thorax rounded and marginated.

* *Lip divided into three little projections.*

This is, in general, a very beautiful genus of insects; they are found in dry sandy places, and prey with the most ravenous ferocity upon all other insects which come in their way, and which they can overcome. The larva is soft, white, long, and has six feet, with a brown scaly head; and lurks in a round perpendicular hole in the ground, with its head at the entrance, to draw in, and devour whatever insects may come near, or fall into it.

Green; the elytra marked with five white dots. 1. A native of Europe; in sandy plains. The upper part of the antennæ brown, the under part red; thorax a little angular, rough; elytra irregularly dotted; upper lip white; jaws projecting, sharp; legs red, with a coppery tinge. * *campestris.*

Purple; the elytra marked with a white band, and two white circular dots. 2. A native of Europe; in sandy places. * *hybrida.*

Of a copper colour; the elytra green, marked with a white spot, like a crescent, at the tip. 4. A native of Europe. It varies in colour, being sometimes blue, green, or black. *germanica.*

Black, above bright brown; the elytra with lateral striæ at a good distance from one another. 40. A native of Europe. *danica.*

Black, on the upper part nearly of the colour of brass; the elytra striated, marked with four impressed dots; legs a yellowish brown. 41. A native of Europe. *punctata.*

Of a rusty colour; legs, elytra, head, and thorax reddish; the latter green behind; the elytra are marked with a waved green band, and have a green suture. 49. A native of Europe; in water. Head two-lobed behind; lip white; thorax jagged on the fore part; it has no scutellum; elytra with each 15 punctured striæ, and three spots at the base near the anterior margin. *ferruginea*

* * *Lip rounded, pointed, entire.* Elaphrus.

Of a bright greenish yellow; the elytra marked with broad concave points. 10. A native of Europe; in moist places. * *riparia.*

Of an obscure brass colour; the elytra somewhat cloudy, legs yellow. 11. A native of Europe; on banks. The elytra are sometimes dotted; antennæ black, the first joint yellow; thorax rounded, and grooved on the back. * *flavipes.*

Black; the elytra brown, marked with two pale spots, the shanks of the legs reddish. 13. A native of Europe. *quadrimaculata.*

Of a bright brass colour, polished; head striated. 14. A native of Europe; common in water. * *aquatica.*

48 species of this genus have been described in the last edition of the System of Nature.

42. Buprestis, the *Cow-burner*.

Antennæ filiform, serrated, and of the same length with the thorax. Feelers four, filiform; the last articulation obtuse and terminating abruptly. Head half drawn back within the thorax.

This is a genus remarkable for its rich metallic colours,

lours, having frequently the appearance of the moſt highly poliſhed gold or copper; the larvæ are uſually found among timber, and in decayed trees.

vittata. The elytra dotted, and furniſhed with two little projections; they are likewiſe marked with four elevated lines, and with a broad fillet of green and gold. 33. A native of India.

faſtuoſa. The elytra terminating abruptly, furniſhed with two ſmall projections, green, and marked with dotted ſtriæ; the back is of a bright golden colour. 34. A native of America.

berolinenſis The elytra variegated with green and black, and furniſhed with two ſmall projections; the anus is furniſhed with three ſmall projections. 36. A native of Europe.

octoguttata The elytra formed like the roof of a houſe, and deſtitute of projections, marked with four white ſpots; body blue. 2. A native of Europe; in groves.

maculoſa. The elytra black, ſtriated, furniſhed with projections, and terminating abruptly, marked with four yellow ſpots. 50. A native of Europe; of a middle ſize. Head and abdomen green and gold; the legs and thorax black; the edge of the latter yellow.

mariana. The elytra are ſerrated, and marked with longitudinal wrinkles, likewiſe with two impreſſed ſpots; the thorax furrowed. 6. A native of Europe.

* *chryſocephala.* The elytra are ſerrated, marked with two golden impreſſed ſpots, and longitudinal furrows; the thorax dotted. 7. A native of Europe.

* *ruſtica.* The elytra formed like the roof of a houſe, and ſtriated; the thorax dotted. 8. A native of Europe; in groves.

* *ſalicis.* Shining green; the elytra entire, of a golden colour, and green at the baſe. 85. A native of Europe; on the willow.

120 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

43. Hydrophilus.

Antennæ clavated; the club perforated. Feelers four, filiform. The hind-legs hairy, formed for ſwimming, and almoſt deſtitute of nails or claws.

The inſects of this and the next genus, *dytiſcus*, are inhabitants of ponds and ſtagnant waters, where they ſwim with much dexterity, turning round with great velocity. They fly abroad by night in ſearch of other waters. The males are diſtinguiſhed from the females, by having a horny concave flap or ſhield on the fore-legs, near the ſetting-on of the feet; the hind-legs are peculiarly fitted for their aquatic ſituation, being furniſhed on the inner ſide with a ſeries of long and cloſe-ſet filaments, reſembling a fin, by which they are enabled to ſwim with great eaſe and celerity. The larvæ remain about two years and a half before they change into pupæ, forming a convenient cell, and ſecreting themſelves in ſome bank; are extremely voracious and deſtructive to the more tender aquatic inſects, worms, and young fiſh, which they ravenouſly ſeize with their forked jaws, and deſtroy by ſucking out their juice.

* *piceus.* *Water-clock.* Black; breaſt grooved, with a long ſpine pointing backwards. 1. A native of Europe. The larva appears to have its legs ſeated on the upper part of the body near the back; but this is occaſioned by the peculiar ſhape and poſition of the legs; the female ſpins a flattiſh circular web, terminated by a long tapering horn, from which the young eſcape, as ſoon as they are hatched.

* *caraboides.* Black, ſhining; the elytra ſomewhat ſtriated. 2. A native of Europe.

* *ſcarabæoides.* Black, ſhining; the edges of the thorax and elytra yellow. 3 A native of Europe. Feelers filiform.

* *minutus.* Oval, black; the elytra and legs gray. 11. A native of Europe. It makes a buzzing noiſe in the evening. Thorax is ſometimes gray.

pilula. Black, ſhining above, and thickly dotted. 13. A native of Europe.

Twenty ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

44. Dytiscus.

Antennæ ſetaceous. Feelers ſix, filiform. The hind-legs hairy, almoſt entirely deſtitute of claws or nails, and formed for ſwimming.

* *latiſſimus.* Black; the edges of the elytra dilated, marked with a yellow line. 6. A native of Europe. It is ſo voracious as even to deſtroy its own ſpecies. The male is ſmooth, the female grooved.

* *marginalis.* Black; the whole of the edge of the thorax, and the outer edge of the elytra, yellow. 7. A native of Europe. The fore-feet of the male have a hemiſpherical appendage, with two circular cavities in the middle. The female is ſemiſtriated.

* *ſemiſtriata.* Brown; the elytra hairy, marked with ten furrows, reaching half their length. 8. A native of Europe. It is furniſhed with a ſharp crooked concealed ſword. Its eggs are oblong, large, and white.

* *fulcatus.* The elytra marked with ten longitudinal furrows, and are hairy. 3. A native of Europe and America. The elytra of the male are ſmooth.

notatus. Brown; thorax yellow, marked with four black dots. 31. A native of Europe. The thorax is ſometimes reddiſh, ſometimes variegated with black dots, or with a ſhort black band.

d preſſus. The thorax of a ruſty colour, marked with two black dots at the baſe; the elytra brown, ſpotted with red. 32. A native of Europe.

* *glaber.* Brown; the elytra ſmooth; the legs and belly of a ruſty colour. 86. A native of Britain; in ſtagnant waters.

* *nebuloſus* Bluiſh, clouded with black; the antennæ and legs of a ruſty colour; the belly black, the margin of a light-brown colour. 87. A native of Britain; in ſtagnant waters.

133 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

45. Carabus, *Bull-head.*

Antennæ filiform. Feelers ſix; the laſt articulation obtuſe, and terminating abruptly. Thorax heart-ſhaped; ſmaller end which terminates abruptly being next the body. Both thorax and elytra are marginated.

Theſe inſects are exceedingly active and quick in running: they devour the larvæ of other inſects, and all the weaker animals they can overcome; the legs are long,

long, thighs compreſſed, ſhanks rounded and ciliated within; the fore ones prickly before; the larvæ are found under ground or in decayed wood.

** Majores.*

coriaceus. Black, opake; without wings; the elytra connected and marked with dots which run into one another, and ſomewhat wrinkled. 1. A native of Europe; in woods. One of the largeſt ſpecies in Europe; head and thorax irregularly dotted; body beneath ſhining.

** granulatus.* Without wings, and blackiſh; the elytra of the colour of braſs, ſtriated, and marked with elevated dots, placed between the ſtriæ. 2. A native of Europe; in fields.

** hortenſis.* Without wings; black, the elytra ſmooth, marked with a triple row of bright yellow depreſſed dots, and with a blue edge. 3. A native of Europe; in gardens and woods. The dots on the elytra are ſometimes of the ſame colour with the elytra.

arvenſis. Without wings, and of a blackiſh copper colour; the elytra ſtriated, and marked with a triple row of concave dots. 42. A native of Europe.

** niteus.* Without wings; the elytra rough, green, with longitudinal raiſed lines, the edge golden; legs black. 6. A native of Europe; in woods.

** auratus.* Without wings; the elytra gilt, and marked with elevated ridges and ſmooth furrows. 7. A native of Europe; in cloſe confined places in woods.

violaceus. Winged; the elytra ſomewhat ſmooth, black, with a gilt edge; the thorax of a violet colour. 8. A native of Europe; very common in woods.

** ſycophanta.* Shining golden colour; the thorax blue; the elytra marked with ſtrips of green and gold. 12. A native of Europe. This is the largeſt of this genus that is to be met with in Europe; the larva is black, it attacks caterpillars by night, and devours them.

adſperſus. Without wings; above of an obſcure greeniſh yellow; beneath black; the elytra marked with four rows of concave ſpots, and with furrows. 82. A native of Europe; in woods, under ground. The elytra are ſometimes black.

** * Minores.*

fabuloſus. Pale; the head black, and a black ſpot in the elytra. 96. A native of Europe; in ſandy grounds.

** ruſicornis.* Black; the elytra ſmooth, and furrowed, the antennæ and legs reddiſh. 97. A native of Europe; in woods frequently.

** pilicornis* The thorax roundiſh; the elytra ſtriated, and marked with impreſſed dots; the antennæ hairy. 104. A native of Britain. It is ſometimes black, ſometimes of a bright yellow.

** ſpinibarbis.* Blue; the thorax ſpherical; mouth, antennæ, and ſhanks of the legs reddiſh. 105. A native of England.

crepitans. The thorax, head, and legs, of a ruſty colour; the elytra black. 13. A native of Europe; in groves. It purſues the larger beetles, driving them away by the noiſe made by its belly.

280 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

46. Tenebrio.

Antennæ moniliform; the laſt articulation roundiſh. Thorax flat on one ſide, and convex on the other, and margined. Head projecting. Elytra ſomewhat rigid.

** Feelers ſix, filiform; the Fore-legs formed for digging, furniſhed with projections at the extremity like a hand.*

The larvæ of ſome of the ſpecies of this genus live in damp places under ground among rubbiſh; of others in flour and different kinds of food, where they perform their metamorphoſis. The perfect inſects are very troubleſome in houſes, eating bread, meal &c.; they precipitately avoid the light; reſort to damp cellars, and dark places, where putrefaction allures and nouriſhes them. They are all of a very dark gloomy appearance, from which circumſtance they have received their name.

Black; thorax nearly ſquare; the elytra very ſmooth. 13. A native of Cayenne; large. *complanatus.*

Black. 7. A native of Europe; on ſand hills, in which it digs holes. ** foſſor.*

Brown; thorax oblong, marked with five projecting angles. 8. A native of Europe; in ſand hills. ** curſor.*

** * Feelers unequal; filiform.*

Wholly black, and ſmooth. 21. A native of Egypt; the elytra joined together, the fore legs furniſhed with two projections. *atratus.*

** * * Feelers four; the anterior ones faintly clavated, the poſterior ones filiform.*

Black; the thorax nearly ſquare and ſmooth; the elytra furrowed; the ſhanks of the fore legs crooked and ſharp, terminating in a ruſty-coloured plate. 22. A native of India; the largeſt of the genus. *laminatus.*

Black; the elytra ſtriated; thorax ſmooth. 1. A native of Surinam, about the ſize of the ſtag-beetle; the antennæ are ſomewhat clavated. *gigas.*

Wholly black; the thighs of the fore legs thicker than thoſe of the reſt. 2. A native of Europe; among flour, in bake-houſes, mills, dry bread &c. The larva is white, ſoft, and ſmooth, compoſed of thirteen ſegments; it is eagerly ſought after by the nightingales. ** molitor.*

Of a ruſty colour; the elytra ſtriated, the ſhield emarginated. A native of Europe; in looſe ſand, in rubbiſh, and in granaries. *culinaris.*

Black above; beneath of a deeper and brighter black; the elytra marked with five elevated ſtriæ on each ſide. 45. A native of Europe, in orchards; the larva covered with a looſe net, by twos or threes lurk in the folded leaves. *pomona.*

The thorax marked with two cavities; the elytra of a violet colour or reddiſh; the antennæ and legs of a ruſty colour. 57. A native of Europe. The larva is to be met with in the trunks of pine trees that have been cut down, the inner bark of which they conſume; the inſect is, when full grown, about half an inch long. *lignarius.*

64 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

47. Pimelia.

Antennæ filiform. Feelers four. Thorax flat on one ſide, and convex on the other and marginated. Head projecting.

jecting. Elytra ſlightly ridged. Wings are wanting in many of the ſpecies.

** Antennæ moniliform towards their extremity.*

A. *Feelers clavated.*

gages. Black; thorax roundiſh; the elytra ſharp pointed and very ſmooth. 1. A native of Europe.

ſulcata. The elytra furniſhed with ſharp points, and furrowed. 2. A native of Egypt; common in gardens. They are recommended as remedies in the earache, and againſt the bite of ſcorpions; the Turkiſh women dreſs and eat them, and think them very fattening.

** mortiſaga.* Black; the elytra are furniſhed with ſharp points, and ſmooth. 3. A native of Europe; in ſhady cloſe ſituations. This inſect is regarded as a preſage of the death of one of the family, by the common people in Sweden, when it is ſeen crawling about the houſe.

B. *Feelers filiform.*

muricata. Black; the elytra obtuſe, ſtriated, and furniſhed with ſharp points. 20. A native of Europe, and the northern parts of Africa and Aſia; it makes a noiſe by rubbing its hind legs againſt its elytra; it reſembles the *mortiſaga*, but larger.

ſtriatula. Black; the elytra oblong, oval, and ſtriated. 54. A native of Europe.

*** The Antennæ filiform through their whole length.*

A. *Feelers four, filiform.*

tricuſpidata. The thorax furniſhed with three ſharp points; body gray. 56. A native of Egypt.

B. *The anterior feelers hatchet-ſhaped, the poſterior ones clavated.*

cærulea. Bluiſh; the thorax nearly round, the elytra ſtriated. 61. A native of Europe.

** anglica.* Black; the thorax roundiſh before; the elytra dotted and ſtriated; the antennæ reddiſh at the tips. 76. A native of England.

buparia. Black; ſmooth and furniſhed with wings; the thorax circular; the jaws ſtrong, furniſhed with teeth, and longer than the head. 84. A native of Europe.

84 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

48. MANTICORA.

Antennæ filiform. The articulations cylindrical. Feelers four, filiform. Thorax roundiſh before, and emarginated at the tip behind. Head projecting. Jaws projecting. Elytra united. No wings.

maxilloſa. 1. A native of the Cape of Good Hope; body large, black; head nearly globular, and impreſſed on each ſide; jaws furniſhed with teeth at the baſe; thorax impreſſed in the middle, and clavated behind, the margin rounded and notched at the tip; elytra above, flat and rough, deflected at the edge with a very ſharp lateral ſerrated line; legs ſimple, black.

Only one ſpecies of this genus has been deſcribed.

49. ERODIUS.

Antennæ moniliform. Feelers four, filiform. Jaw horny, bifid, and ending abruptly. Lip horny, emarginated.

teſtudinarius. Hunch-backed, black; the elytra united and rough; the ſides duſty white. 1. A native of the Cape of Good Hope; large, flat beneath.

Hunch-backed, black; the elytra marked with three dotted lines. 2. A native of Africa; in looſe ſand, and very common in Egypt. *gibbus.*

Black; the elytra marked with one clavated line. 3. A native of Egypt. *planus.*

Black; the elytra very ſmooth. 4. A native of Aſia. *minutus.*

Only four ſpecies of this genus have been deſcribed.

50. LYTTA.

Antennæ filiform. Feelers four, unequal; the poſterior pair clavated. Thorax roundiſh. Head inflected, and turgid on the upper ſide. Elytra ſoft, and flexible.

Green; the antennæ black. 1. A native of Europe; on the privet, the aſh, the elder, the lilach both common and Perſian, the poplar, and on the Tartarian woodbine. *veſicatoria.*

This inſect is uſed in pharmacy, chiefly for the purpoſe of raiſing bliſters. It multiplies greatly, and has a nauſeous ſmell, not much unlike that of mice; which helps to conduct thoſe who go in queſt of them. The odorous particles exhaled from them are extremely corroſive. They were formerly ranked among the *cantharides*; more recently in the genus *meloë*. More accurate obſervation has placed them in the genus *lytta*.

Green and gold; the elytra reddiſh brown. 2. A native of England. ** nitidula.*

Black, ſmooth; breaſt downy; the elytra grayiſh yellow, marked with two black and almoſt ſquare ſpots. 14. A native of the north of Aſia. A pleaſant ſmelling oil exſudes from its legs. *quadrimaculata.*

Smooth, pale reddiſh brown; thorax depreſſed; elytra gray, and black at the tips, and marked with two ſquare glazed ſpots. 15. A native of the north of Aſia, among flowers; of a middle ſize. A pleaſant ſmelling oil is likewiſe exſuded from its legs. *feneſtrata.*

Brown; the fore part of the elytra, and the thorax, which are elongated, are red. 29. A native of Europe. *formicaria.*

29 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

51. MELOE, *the Bloſſom-eater.*

Antennæ moniliform. Thorax roundiſh. Elytra ſoft, and flexible. Head inflated, and turgid on the upper ſide.

The larva as well as the perfect inſect, both of this and the preceding genus, feed on leaves.

** No Wings; Elytra ſhortened.*

Body of a violet colour. 1. A native of Europe. It is to be met with, particularly in the ſpring, in ſandy plains. They feed on the ranunculus and veratrum; its eggs have a pleaſant ſmell; when touched, a very thin yellowiſh oil exſudes from the joints of its legs. It is recommended as a remedy in the hydrophobia. The female is thrice as large as the male. ** proſcara. bæus.*

The ſegments of the abdomen red. 2. A native of the ſouth of Europe. *majalis.*

** Furniſhed with Wings; the Elytra covering the Wings.*

A. *Jaw bifid.*

Black; the elytra yellow, marked with three black bands. *cicborci.*

bands. 5. A native of Aſia, and the eaſt of Europe. It is uſed in medicine among the Chineſe. The antennæ are ſometimes yellow at the tips.

decempunctatus. Black; the elytra reddiſh, marked with five black dots. 6. A native of Italy. The laſt articulation of of the antennæ clavated.

B. *Jaw entire.*

ſchæfferi. Green; the antennæ and legs yellow. 12. A native of Europe.

ſchreberi. Green; the antennæ, legs, and three ſegments of the abdomen, yellow.

32 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

52. MORDELLA, *the Nibbler.*

Antennæ moniliform or pectinated. Feelers four; the anterior pair clavated, the poſterior filiform. Head bent down under the neck. Elytra bent downwards towards the lip. Before the thighs, and at the baſe of the abdomen, there is a broad plate.

* *Antennæ pectinated.*

paradoxa. The ſides of the thorax, and the elytra, a brick colour. 1. A native of Europe; on umbelliferous plants.

flabellata. Reddiſh brown; mouth, breaſt, and upper part of the abdomen, black. 10. A native of Europe.

** *Antennæ moniliform.*

bimaculata Of a ruſty colour; breaſt black; elytra reddiſh marked with a black ſpot. 13. A native of Europe. Large.

* *aculeata.* Black; the anus terminating in a ſpine. 2. A native of Europe; on umbelliferous, and a variety of other plants.

* *abdominalis.* Black; thorax and abdomen tawny; the anus terminating in a ſpine. 19. A native of Europe.

* *humeralis.* Black; the mouth, ſides of the thorax, and legs yellow. 3. A native of Europe; on flowers.

* *licolor.* Black; the elytra reddiſh, black at the tip, and marked with a black band in the middle. 25. A native of Britain; very common on the flowers of the hawthorn, of the dock, and of ſome kinds of umbelliferous plants. Very ſmall.

*** *Antennæ clavated.*

* *clavicornis.* Wholly black. 23. A native of Europe; on the rhubarb.

28 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

53. STAPHYLINUS, *Rove-beetle.*

Antennæ moniliform. Feelers four. Elytra half the length of the body. Wings covered. Tail ſimple, furniſhed with two veſicles, which can be thruſt out at pleaſure.

This is an extremely rapacious tribe, devouring whatever inſects they can catch, and frequently each other; many of them, when laid hold of, turn up the tail; the jaws are ſtrong and projecting, with which they bite and pinch very hard. Moſt of them are found in damp places, among putrid ſubſtances, and a few upon flowers. The larvæ live under ground.

* *All the Feelers filiform.*

Hairy, black; the thorax and poſterior part of the abdomen black. 1. A native of Europe; in ſandy places. * *hirtus.*

Downy, and aſh coloured, clouded with black. 2. A native of Europe; in dead bodies, and in dung. The elytra blue underneath; larva ſix-footed, naked, pale; the head and three firſt ſegments of the abdomen cheſnut brown; tail with two jointed briſtles, and a cylindrical tubercle beneath. * *murinus.*

Downy black; marked with aſh-coloured bands; the jaws of the ſame length with the head. 3. A native of Europe; in woods, living on plunder. * *maxillofus.*

Black; the thorax and elytra ſhining. 5. A native of Europe; on dead bodies; when recently caught, it diffuſes a very fragrant ſmell. * *politus.*

Black; the edges of the thorax yellowiſh; the elytra of a ruſty colour, with a black edge. 4. A native of Britain. * *nitidulus.*

** *The poſterior Feelers hatchet-ſhaped.*

Reddiſh; the head, poſterior part of the elytra and abdomen, as well as the baſe of the thighs, black. 6. A native of Europe; on the *boletus.* * *rufus.*

Black; the elytra, antennæ, and legs of a ruſty colour. 22. A native of Europe; on the *boletus.* *flavipes.*

*** *The anterior Feelers clavated.*

Reddiſh; the elytra blue; the head and tip of the abdomen black. 9. A native of Europe. *riparius.*

Black; thorax reddiſh; the elytra pale blue. 96. A native of Europe; under ſtones. *ruficollis.*

Black; the poſterior part of the elytra, the legs and antennæ, of a ruſty colour. 14. A native of Europe. *elongatus.*

56. FORFICULA, *the Earwig.*

Antennæ ſetaceous. Feelers unequal and filiform. Elytra half the length of the body. Wings covered. Tail furniſhed with pincers.

The larvæ of the forficula run very quickly. This inſect is very common, and very well known; the pincers at its tail, from whence it has received its Latin name *forficula*, afford a very good diſtinguiſhing mark.

The elytra white at the tip; the antennæ have fourteen articulations. 1. A native of Europe; common in fruit. It is accuſed of creeping into the ears of people while ſleeping, whence it has received its name, *earwig.* * *auricularia.*

Pale above, variegated with black; the anus furniſhed with two projections; the pincers projecting conſiderably, and each furniſhed with one projection. 3. A native of Europe. Very large. *gigantea.*

The elytra reddiſh, without ſpots; the antennæ have ten joints. 2. A native of Europe. The tips of the antennæ are whitiſh. It is rare. * *minor.*

Black; the hind-part of the head and legs reddiſh; back of the elytra marked with a white ſpot. 4. A native of Europe. The antennæ have eleven joints. *bipunctata.*

11 ſpecies of this genus bave been deſcribed in the laſt edition of the Syſtem of Nature.

II. HEMIPTERA.

The mouth and ſnout bent inwards, towards the breaſt. Wings covered with hemelytræ. The upper wings, compoſed of a ſemicruſtaceous ſubſtance, do not form a ſtraight ſuture when ſhut, but the inferior edge of the one paſſes over the ſuperior edge of the other.

55. Blatta, *Cock-roach.*

Head bent inwards. Antennæ ſetaceous. Feelers unequal, filiform. Elytra and wings ſmooth, and ſomewhat reſembling leather. Thorax flattiſh, circular, and marginated. Feet formed for running. Two ſmall horns are ſituated at the tail in moſt of the ſpecies.

Theſe inſects, with their larvæ, wander about by night, and ſecrete themſelves by day. They are fond of warmth, and haunt about houſes, devouring meal, and whatever proviſions they can get at. They run with great celerity; and are deſtroyed by the fumes of charcoal or ſulphur, alſo by the root of the *nymphæa alba* boiled in milk.

gigantea. Livid; the ſhield of the thorax marked with a ſquare cheſnut-coloured ſpot. 1. A native of Aſia and America. It is the largeſt of this genus, being nearly the ſize of a hen's egg.

maderæ. Brown; the thorax and elytra livid, and variegated with brown. 11. A native of the iſland of Madeira; a little ſmaller than the laſt ſpecies.

** americana.* Of a ruſty colour; the ſhield of the thorax whitiſh behind. 4. A native of America; it has been introduced into Europe along with ſugar.

auſtralaſiæ. Of a ruſty colour; the thorax black, marked with a white ring; the elytra marked at the baſe with a ſmall white line. 13. Found in ſhips returning from the ſouth ſeas.

** orientalis.* Of a ruſty brown colour, without ſpots; the elytra ſhort, marked with an oblong furrow. 7. A native of America, and has been introduced into Europe for almoſt two hundred years. Frequent in many countries of Europe, in meal and bread, and other proviſions; likewiſe in ſhoes, which it deſtroys. It ſhuns the light, and runs very quickly. It is much haraſſed by the large *tenthredo cærulea*. The female is without wings; ſhe produces a cylindrical egg, half the ſize of the abdomen.

lapponica. Yellowiſh; the elytra ſpotted with black. 3. A native of Europe; conſuming proviſions. In the moiſt woods however of the eaſt of Europe it is leſs noxious.

germanica Livid; body yellowiſh; the thorax marked with two black parallel lines. 9. A native of Europe.

maculata. Thorax black, with a whitiſh edge; the elytra pale, marked with a large black ſpot near the tip. 25. A native of Europe; in pine foreſts and heaths.

43 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

56. Pneumora.

Body oval, inflated, and tranſparent. Head bent inwards, and furniſhed with jaws. Thorax convex, beneath formed like a keel of a ſhip. Elytra deflected and membranaceous. Legs formed for running.

The whole of this genus ſeem to conſiſt of a mere hollow inflated membrane; by rubbing their legs againſt their bodies, they make a ſhrill noiſe in the twilight; and during the night, they are attracted by a bright light.

Elytra without ſpots. 1. A native of the Cape of Good Hope. Head green; eyes white; between the eyes are three red ſtigmata, and above theſe two ſhort projections; antennæ ſhort, green; thorax rough, with a ſhort tooth before and an impreſſed wrinkle in the middle; the elytra aſh-coloured, reticulated with green, ſometimes marked with very ſmall black dots; they are very rarely yellowiſh or reddiſh; the inſect is about twice the ſize of the houſe-cricket. *immaculata.*

Three ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

15. Mantis, *Soothſayer.*

Head nodding; furniſhed with jaws. Feelers filiform. Antennæ ſetaceous. Wings four, membranaceous, rolled up. Fore-legs compreſſed, notched underneath, furniſhed with one hook, and with a lateral ſetaceous jointed finger; the four hind-legs ſmooth, and formed for walking. Thorax linear, long, and narrow.

The thorax ſomewhat tapering and rough; the elytra very ſhort; the legs prickly. 1. A native of Aſia; wings very large. *gigas.*

Thorax marginated, and marked with ſmall projections; the elytra variegated with green and white; dotted with white along the edge. 17. A native of Alexandria. *mendica.*

The thorax ſmooth; the elytra green; the wings reddiſh at the anterior part, marked with a black ſpot. 6. A native of Europe. This inſect reſts ſometimes on its four hind-legs, ſtretches the fore-legs out to the right or left, and for this reaſon has been ſuppoſed to point out the way to ſtrangers, when aſked. *oratoria.*

The thorax ſomewhat fringed; the elytra greeniſh, marked with a ruſty-coloured ocellus. 8. A native of America and Africa; the half of the ocellus on the elytra is white, ſometimes entirely white. This is ſuppoſed to be the idol of the Hottentots. *precaria.*

Linear, aſh coloured, ſpotted with black. 30. A native of the Cape of Good Hope. This is the tutelary deity of the Hottentots. *fauſta.*

52 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

58 Gryllus, *Cricket.*

Head bent inwards; furniſhed with jaws. Feelers filiform. Antennæ either ſetaceous or filiform. Wings four, either deflected or twiſted; the under wings folded. Hind-legs formed for leaping.

The whole of this genus feed on vegetables, except thoſe contained in the firſt diviſion, *acrida*, which devour other inſects; the *achetæ* deſtroy the roots of plants; the *tettigoniæ* and *locuſtæ*, the leaves or tender ſhoots, in ſome countries laying waſte whole diſtricts; the larvæ and pupæ reſemble the perfect inſects, reſide chiefly under ground, and are ſix footed, voracious and active: ſome of this tribe are uſed as an article of food by the natives of Africa and India; many of them produce ſound by the friction of ſome parts of their body.

** Antennæ the ſhape of a ſword; Head conic, and longer than the thorax.* Acridæ.

naſutus. Body green. 1.

turritus. Head conic; antennæ ſword-ſhaped; the wing tranſparent. A native of Africa and the ſouthern parts of Europe; the mouth placed at the under part of the head; antennæ on the top of the head, and not longer than the thorax.

giganteus. Green; marked with two reddiſh fillets; the antennæ of a ruſty colour; thorax marked with three raiſed lines. 64. A native of America; larger than the *gr. naſutus.*

foliaceus. Wings yellowiſh; the antennæ reſembling a leaf. 67. A native of Aſia.

** * Thorax formed like a keel; Antennæ filiform, ſhorter than the thorax.* Bullæ.

** bipunctatus.* Browniſh; the ſcutellum of the thorax, of the ſame length with the abdomen. 7. A native of Europe; on ſand hills expoſed to the ſunſhine.

** ſubulatus.* The ſcutellum longer than the abdomen. 3. A native of Europe; in ditches. It is ſometimes gray, ſometimes brown.

*** Antennæ ſetaceous; Feelers unequal; Thorax rounded; the Tail furniſhed with two briſtles.*

** gryllotalpa.* *Mole-cricket.* The wings furniſhed with a projection like a tail, and longer than the elytra; the fore-feet formed like hands, and downy. 10. A native of Europe. This troubleſome little animal frequents gardens and cultivated grounds, both of Europe and America, where it burrows below the ground, and is very deſtructive; eating and deſtroying the roots of plants. Body dark brown, hairy; antennæ ſhorter than the body.

monſtroſus. The elytra and wings furniſhed with projections like tails, and rolled up. 73. A native of India.

** domeſticus.* *Houſe-cricket.* The wings furniſhed with a tail and longer than the elytra; legs ſimple; body yellowiſh brown. 12. A native of Europe; in many houſes, about ovens, and kitchen chimneys: wanders about during the whole night, keeping a continual chirping, eſpecially before rain; is ſaid to forſake houſes infeſted by the cockroach. There is a variety of this ſpecies ſix times the ſize of the European. Arſenic or the root of the wild carrot, mixed up into a paſte with flour, is ſometimes made uſe of to poiſon them; but an opinion prevails among the vulgar, that their preſence in any houſe is the cauſe of good fortune; and, therefore, though they be troubleſome, they are unwilling to drive them away.

** campeſtris.* *Field-cricket.* Wings ſhorter than the elytra; body black, and furniſhed with a long ſpine. 13. A native of Europe; chirps from the beginning of May till the end of September, and is ſaid to drive away the houſe-cricket when domeſticated.

pellucens. Whitiſh; thorax of the form of a trapezium. 85. A native of Carniola and Europe; in vineyards and gardens; about half an inch in length; it makes a noiſe during the whole ſummer in the night time; it reſembles the houſe cricket, but larger; the head is ſhining; the thorax is marked with three brown ſpots, the elytra with yellowiſh ones.

** * * Antennæ ſetaceous. Feelers unequal. Tail of the female armed with a projection like a ſword.* Tetigoniæ.

aquilinus. The thorax round, and ſomewhat warty; wings very broad; with 15 nerves. 27. A native of South America and India; large; the elytra of the ſhape of a lance; the ſhanks of the legs ſet with four rows of prickles.

griſeus. Brown; the thorax roundiſh and keel-ſhaped behind, furniſhed with a black crooked ſpine reſembling a ſword, the baſe of which is pale on each ſide. 108. A native of Europe; the antennæ yellow, and of the ſame length with the body; legs greeniſh; the elytra variegated with brown and aſh-colour.

viridiſſimus. The thorax round; the wings green and without ſpots; the antennæ very long. 31. A native of Europe; on trees, in paſture grounds, in barley fields. It makes a noiſe in the night time in warm weather about the time of the dog days.

** verrucivorus.* Thorax nearly ſquare and ſmooth; the wings green, ſpotted with brown; the antennæ ſetaceous, about the ſame length of the body. 34. A native of Europe, and is collected by the common people of Sweden for the purpoſe of deſtroying warts in the hand; which it is ſaid to perform by biting off the excreſcences, and diſcharging on the wound a fluid which cauſes them to decay.

** * * * * Antennæ filiform, Feelers ſimple, Tail unarmed.* Locuſtæ.

elephas. The thorax entirely keel-ſhaped; body without wings. 35. A native of Africa; this is the largeſt and heavieſt of the *Locuſtæ*; green, the thighs ſmooth, the rudiments of two wings.

migratorius. The thorax faintly carinated, compoſed of one ſegment; head obtuſe; jaws black. 41. A native of Tartary, and migrates in incredible ſwarms into various parts of Europe. The miſchief theſe voracious creatures do, when they appear in vaſt ſwarms, far exceeds that done by any other tribe of animals. By ſuddenly deſtroying all vegetation, they change the moſt fertile countries into barren deſerts, leaving behind them deſolation and famine. They have occaſionally appeared in ſmall flights in England, but have periſhed in a ſhort time. This was probably the ſpecies that conſtituted one of the plagues of Egypt. They are eaten by the inhabitants of different countries, particularly by the Egyptians, who roaſt them alive and eat their bodies, after having removed their wings and legs.

** ſtridulus.* The thorax marked with an elevated ridge like a keel, the wings red and black at the tips. 47. A native of Europe; in dry ſandy ſituations, chirping all day long, till late at night. Either black or variegated with black and yellow.

240 ſpecies of this genus have been deſcribed.

59. Fulgora, *Lanthorn fly.*

The head inflated; fore head prominent. The antennæ ſhort, placed under the eyes, compoſed of two articulations, the upper one being the largeſt and globular.

globular. The ſnout long and bent inwards, is a ſheath conſiſting of five articulations. Legs formed for walking.

nterna-ia. The forehead extended, forming a ſtraight beak; wings bluiſh, the under wings marked with ocelli. 1. A native of South America. It emits a very bright light from the prominent part on its forehead. Travellers are ſaid to avail themſelves of the light they emit; two or three of them, fixed on the end of a ſtick, affording light ſufficient to let them ſee in the dark.

iadema. The fore-head ſet with tapering points, and extended into a beak, divided at the tip into three; wings black, ſpotted with red. 2. A native of India.

andelaria The forehead extended into a clavated beak; the elytra green, ſpotted with yellow; the wings yellow with black tips. 3. A native of China.

hoſphorea The forehead raiſed into a tapering beak; body grayiſh yellow. 4. A native of South America.

yalina. The forehead conic and unequal; wings tranſparent, marked with a black ſtreak. 17. A native of Bengal.

20 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

60. CICADA, *Frog-hopper.*

Snout bent inwards. Antennæ ſetaceous. Wings four; membranaceous and deflected. Legs, (in the moſt of the ſpecies) are formed for leaping.

The inſects of this genus feed on the juice of plants; the larva is without wings; the pupa has only the rudiments of wings, but they have both ſix legs; they very much reſemble the perfect inſect, and are very active; the perfect inſect chirps as well as thoſe of the preceding genus.

* *Antennæ tapering at the point, and placed on the forehead.* Membracides.

A. *Thorax compreſſed, membranaceous, and larger than the body.* Foliaceæ.

ſtata. The thorax inflated, light brown and reticulated. 52. A native of Cayenne.

geniſtæ. The thorax brown; lengthened out behind, the abdomen being half the length of the thorax. 56. A native of England; on the *geniſta tinctoria.*

ermis. The thorax greeniſh, tapering to a point, and of the ſame length with the abdomen. 57. A native of America, on plants.

B. *The thorax furniſhed with a horn on each ſide.* Cruciatæ.

cornuta. The thorax furniſhed with two horns; black, tapering to a point behind, and of the ſame length with the abdomen; wings brown. 6. A native of Europe; on thiſtles and willows.

* * *Legs not formed for leaping.* Maniferæ.

lebeia. The tip of the ſcutellum marked with two ſmall projections; the elytra marked with four anaſtomoſes, and ſix lines of a ruſty colour. 15. A native of Europe and Africa, very large. Of this inſect Virgil ſays, *et cantu quærulæ rumpent arbuſta cicadæ*, and *ſole ſub ardente reſonant arbuſta cicadis.*

ni. Black, ſpotted with yellow; the elytra are ſurrounded with a thin edge, with ſix brown connected dots; the wings are white, marked with two black ſpots, and yellow at the baſe. 16. A native of Europe; the larva is eatable.

* * * *Antennæ filiform, ſituated under the eyes.*

A. *The ſheath of the ſnout ſtretched out, obtuſe, and grooved above.* Cercopides.

Yellowiſh; the elytra brown, marked with two white bands. 11. A native of Europe; on plants of different kinds. *bifaſciata.*

Brown; the elytra are marked on the ſides with two white ſpots, and with a double interrupted whitiſh band. 24. A native of Europe; on various plants, frequently on the roſe, on graſs and oſier; the larvæ and pupæ of this, and ſome others of the genus, diſcharge a frothy matter from numerous pores about the tail, within which they are completely encloſed; this is frequently found in ſummer on various plants, very much reſembling a quantity of ſaliva, and is commonly known by the name of *cuckow ſpit*; the perfect inſect will frequently leap two or three yards to eſcape from any one who attempts to catch it. * *ſpumaria.*

Brown; the fore part of the thorax marked with impreſſed dots, the elytra marked on the ſides with two white ſpots. 212. A native of Europe. *punctulata.*

† † *The ſheath of the ſnout very ſhort, membranaceous, cylindrical, obtuſe.*

* *Legs formed for leaping.* Ranatræ.

Brown; wings tranſparent, ſpotted with brown, and marked with dotted ribs. 25. A native of Europe; on plants. *nervoſa.*

Yellow; the elytra gilt and brown. 123. A native of Britain; on plants. * *fulgida.*

§ § *The wings deflected, covering the ſides.* Deflexæ.

Yellow; the elytra marked with brown, with four black ſpots, and gilt behind. 48. A native of Europe. *aurata.*

Yellowiſh; the elytra marked with blood-coloured ſpots, and brown at the tips. 173. A native of Europe; on the oak. *quercus.*

240 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

61. NOTONECTA, *Boat-fly.*

Snout bent inwards. Antennæ ſhorter than the thorax. Wings four, folded croſs-wiſe, the upper ones coriaceous. Hind legs hairy, formed for ſwimming.

The inſects of this and the next genus, *Nepa*, live in ſtagnant waters, and prey on aquatic animals; the larvæ and pupæ are ſix-footed, active, and ſwim readily, and very much reſemble the perfect inſect; the larvæ is deſtitute of wings, the pupæ have only the rudiments of wings.

* *Lip long.*

The elytra gray, dotted with brown along the edge, and divided at the tip. 1. A native of Europe; in waters, very troubleſome to fiſh. It ſwims on its back, for which reaſon it has been called by the Greek name of *notonecta*. The hind legs, which are longer than the reſt, ſerve it as oars. When caught, it muſt be cautiouſly handled, as the point of its ſnout is very ſharp, and its puncture very painful. * *glauca.*

* * *No*

* * *No lip.* Sigaræ.

**ſtriata.* The elytra brown; marked with a great number of croſs waved lines of a darker colour. 2. A native of Europe.

14 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

62. Nepa, *Water Scorpion.*

Snout bent inwards. Antennæ ſhort. Wings four, folded croſs-wiſe, the upper ones coriaceous. The fore-legs formed like claws; the other four are formed for walking.

The inſects of this genus are very voracious, and feed on other aquatic animals, which they pierce and tear with their ſharp ſnout, while they hold them with the claws of their fore-legs. They fly well, eſpecially in the evening and night, and convey themſelves from one pool to another, particularly when water begins to fail in the pool they have been in.

* *Antennæ divided into ſeveral diviſions reſembling a hand; Lip wanting.*

**cinerea.* Aſh-coloured; thorax unequal; body long and oval. 5. A native of Europe; in ſtagnant waters; the upper part of the abdomen red.

**linearis.* Linear; the claws furniſhed with a lateral ſpine. 7. A native of Europe and India, in freſh water. The eggs of this inſect are furniſhed at one end with two hairs; they depoſit them in holes made in ſtalks of ruſhes, leaving the hairs ſtanding out.

* * *Lip ſtretched out and roundiſh.* Naucorides.

**cimicoides.* The edge of the abdomen ſlightly notched. 6. A native of Europe.

Twelve ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

63. Cimex, *Bug.*

Snout bent inwards. Antennæ longer than the thorax. Wings four, folded croſswiſe; the upper wings coriaceous in the fore part. Back flat. Thorax marginated. Legs formed for running.

Moſt bugs have a bad ſmell; all of them except the *reduvii*, feed on the juice of plants, and all of them, without exception, on the juices of animals, particularly of the ſofter inſects, which they ſuck by means of their ſnout. The larvæ and pupæ have ſix feet, run quickly, and very much reſemble the perfect inſect; the larvæ have no wings, only ſtumps of wings.

* *Antennæ placed before the Eyes.*

A. *Lip wanting.* Acanthiæ.

† *Without Wings.*

**lectularius.* *Houſe-bug.* Without wings. 1. A native of Europe, though originally a foreigner; it was introduced into Europe before the Chriſtian era, but not into Britain until the ſeventeenth century, being little known before the year 1670. It is a troubleſome and nauſeous inhabitant of moſt houſes in large towns; crawling about in the night time to ſuck the blood of ſuch as are aſleep, and hiding itſelf by day in the moſt retired holes and crevices.

†† *The Elytra almoſt totally coriaceous.* Coleoptrati.

Black; without wings; the elytra oval, with yellow edges, and ſhorter than the abdomen. 13. A native of Europe. The thorax reſembling the *gryllus*. *grylloides*

††† *Membranaceous and very flat.*

The thorax divided into three wings; the ſcutellum reſembling a leaf; the elytra reticulated and ſwelling out at the baſe. 137. A native of Europe; on the under ſurface of the leaves of the pear tree, which become ſpotted with its punctures. * *pyri.*

B. *Lip long, tapering to a point at the extremity.*

† *The Scutellum of the ſame length with the Abdomen.* Scutellati.

Black; the thorax marked with five, and the ſcutellum with three orange-coloured lines; the abdomen yellow, dotted with black. 6. There is a variety of this ſpecies. *lineatus.*

(β) Red; the thorax marked with five, and the ſcutellum with three black lines; the abdomen yellow, dotted with black. A native of Europe; on the flowers of the apple and elder. *nigrolineatus.*

†† *The Thorax armed with a ſpine on each ſide.* Spinoſi.

The thorax armed with blunt prickles; the elytra gray, marked with a brown ſpot, the ſhield emarginated. 190. A native of England; in thickets. * *luridus.*

††† *Thorax without ſpines.*

A. *Rotundati, ſuch as are round or oval.*

Somewhat tawny, the edge of the abdomen ſpotted with brown. 45. A native of Europe; on berries. * *baccharum.*

Blue, with a metallic luſtre; the thorax marked with a ſmall line; the tip of the ſcutellum, and dots on the elytra, all of a red or white colour. 53. A native of Europe; on tetradynamious plants. It is very deſtructive to cabbages and to turnip fields. * *oleraceus*

B. *Such as have the Thorax oblong.*

† *Antennæ terminating in ſmall hairs.*

Black; head, thorax, and legs reddiſh. 364. A native of England. * *flavicollis.*

* * *Antennæ clavated.*

Brown; head and thorax reddiſh. 679. A native of Europe. *ictericus.*

C. *Antennæ filiform.*

‡ *Legs ſmooth.*

Yellowiſh; elytra green. 36. A native of Europe; in meadows. * *pratenſis.*

‡ ‡ *Legs*

‡ ‡. *Legs notched or prickly.*

alcaratus. Brown; the upper part of the abdomen of a blood colour; the thighs of the hind-legs furnished with six sharp projections. 114. A native of Europe.

D. *Antennæ setaceous.*

‡ *Legs notched.*

lictis. Spotted, with tawny coloured spots; legs reddish; thighs thick. 115. A native of Europe; on the fir tree.

‡ ‡ *Legs without prickles.*

atulinus. Green, without spots; wings transparent. 83. A native of Europe; in meadows.

§ § § *Linear; Body oblong and narrow.*

‖ *Antennæ setaceous.*

edes. Variegated, with brown and yellow; the thighs of the hind-legs long and notched. 524. A native of India.

‖ ‖ *Antennæ filiform.*

flagno-um. Black and tapering; the thorax marked in the centre with two globular dots. 113. A native of England; very common in lakes.

‖ ‖ ‖ *Antennæ clavated.*

-ispinosus. Greenish brown; the antennæ long, with three erect prickles on the back. 542. A native of Surinam.

‖ ‖ ‖ ‖ *Antennæ double clavated.*

tecicus. Ash-coloured; the thighs clavated. 543. A native of Europe.

‖ ‖ ‖ ‖ ‖ *Antennæ with two terminations.*

pularius. Whitish; all the legs very long; the thighs clavated. 120. A native of Europe; on mosses.

* * *The Antennæ placed above the Eyes; the Snout arched.* Reduvii.

ersonatus. The antennæ resembling hairs at the tips; body somewhat hairy and brown. 67. A native of Europe; in rubbish. The larva is rough, and destroys the house-bug.

ridulus. Smooth, black; the elytra brown, spotted with black, and with a red edge. 557. A native of Europe. It is small, and moves about with great agility early in the spring; it keeps its antennæ in constant motion, and makes a shrill noise by rubbing them against the thorax.

693 species of this genus have been described in the last edition of the System of Nature.

54. Macrocephalus.

Snout bent inwards. Sheath of one valve, and consisting of three articulations, and furnished with three bristles, destitute of jaws, feelers, and lip. Antennæ stretched forwards, very short, clavated, and nearly moniliform. Head oblong, cylindrical above. Scutellum of the length of the abdomen, flat and membranaceous.

A grayish-reddish colour; the scutellum of an ash-colour; a yellow spot on the elytra; the wings of a purplish violet colour; the thighs of the fore-legs thickened. 1. A native of America. *cimicoides.*

Only one species of this genus has been described in the last edition of the System of Nature.

65. Aphis, *Plant-louse* or *Vine-fretter.*

Snout bent inwards; a sheath of five joints, furnished with one bristle. Antennæ setaceous, and longer than the thorax. Wings four, erect in none. Legs formed for walking. Abdomen frequently terminating in two horns.

The minute animals which compose this singular genus, infest various plants, generally in large societies, hindering their growth, and consuming their juices. A peculiarity in the mode of their propagation attracted the attention of naturalists a good deal towards the beginning and about the middle of last century. Reaumur, from some observations of his own, and from the opinions of some preceding observers, was led to believe, that they propagated without sexual connection. Bonnet adopted the same opinion, and thought he had established it beyond controversy by some very accurate experiments and observations of his own, which he communicated to the Royal Academy of Sciences. He shut up a young aphis, at the instant of its birth, in the most perfect solitude, which nevertheless brought forth 95 young ones in his sight. The same experiment being repeated on one of this family, it multiplied like its parent; and one of this third generation, brought up in solitude, proved no less fruitful than the others. Repeated experiments, in this respect, as far as the fifth or sixth generation, all uniformly afforded the same result. A suspicion entertained by Mr Trembley induced Mr Bonnet to repeat his experiments with still more accuracy, and to continue them longer. He reared to the amount of the tenth generation of solitary aphides, and had the patience to keep an account of the days and hours of the births of each generation: he discovered, that they are really distinguished by sexes; that the males are produced only in the tenth generation, and are but few in number; that these soon arrive at their full growth, and copulate with the females; that the virtue of this copulation serves for ten generations: he likewise found that they were viviparous during spring and summer; and that they were oviparous only in the tenth generation; that from these eggs the aphides of the following year were hatched early in the spring. His observations have been repeated by other naturalists, particularly by Dr Richardson of Rippon, who has given a very minute account of his observations, in a paper published in the Philosophical Transactions, vol. xi. art. 22. These little animals discharge from their anus a sweet fluid, commonly called *honey-dew*, which attracts the bees and ants. The species are very difficultly distinguished: it is still more difficult to describe them; different species are sometimes found on the same plant.

Of

* *longiroſtris.* Of an aſh-colour; the ſnout three times the length of the body. 34. A native of Europe; under the barks of trees; feeds on the larvæ of the ants.

* *vitis.* 56. A native of Europe; on the vine. This deſtructive little inſect cuts through the peduncles, or ſtems which ſupport the cluſters of grapes, in their very early ſtage, cauſing them to wither and drop off ſoon after the fruit is formed.

* *piſtaciæ.* Black; wings whitiſh; ſhanks of the legs very long; the thorax warty. 33. A native of Europe and Aſia; on the piſtachia: the antennæ moniliform; eyes blackiſh; the abdomen without briſtles, covered with white down, mixed with ſmall balls; the wings ſometimes erect. It is lodged in a follicle ariſing from the baſe of the leaf, ſwelling out in the middle, and tapering towards each end, of more than an inch in thickneſs, at firſt green, after the inſects have left it becoming fleſh-coloured.

77 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

66. Chermes.

The ſnout is a ſheath placed in the breaſt, furniſhed with three briſtles, bent inwards. Antennæ cylindrical, longer than the thorax. Wings four, deflected. Thorax turgid on the upper ſide. Legs formed for leaping.

Theſe inſects inhabit various trees and plants, and produce by their punctures, protuberances and excreſcences of various ſhapes and ſizes, in which are frequently encloſed the eggs, and inſects in their ſeveral ſtates; the larva is ſix-footed and apterous; the pupa is diſtinguiſhed by two protuberances on the thorax, which are the rudiments of future wings.

* *graminis* 1. A native of Europe; on graſſes, particularly the *aira flexuoſa.*

* *caſtanea.* Brown; the antennæ ſetaceous and ſmooth; the wings very much ribbed. 21. A native of Europe; on different plants.

Twenty-ſix ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

67. Coccus, *Cochineal.*

The ſnout furniſhed with briſtles, ſituated in the breaſt. Antennæ filiform. The anus furniſhed with briſtles. Male with two erect wings; female without wings.

Theſe are extremely fertile, and very troubleſome in hothouſes and greenhouſes: the male is very active, with an oblong body, and ovate abdomen; the tail furniſhed with a ſtyle and two long briſtles: the female has a body nearly globular, and is inactive and fixed to different parts of plants.

heſperidum. Oval, oblong. 1. A native of Europe; on evergreen plants, in greenhouſes, *e. g.* the orange, the laurel, &c.

adonidum. Reddiſh, duſted over with powder, and hairy. 4. A native of America and Africa, lately in the warmer parts of Europe; on trees. Body oval and whitiſh; antennæ and legs brown, marked on the back with an elevated line, and with a raiſed dot on each of its ſegments, with the edges of the ſide acute, furniſhed with fourteen prominent ſegments and raiſed dots; its ſurface ſprinkled with as many dots ſet longitudinally between the clavated line on the back and the edge; the tail divided: the perfect inſect conſtructs a follicle in which it conceals itſelf and its yellow eggs.

polonicus Body oblong, ovate; purple or cheſnut. 17. On the roots of the *ſcleranthus perennis.*—This inſect without impropriety may be called the cochineal of the northern part of the world. It prefers cold climates, and is commonly called *coccus tinctorius polonicus*, or the *ſcarlet grain* of Poland. Ray calls the plant on which it feeds the *polygonum cocciferum;* but it is not confined to one kind of vegetable, for it is found on the mouſe-ear, pimpernel, and pellitory, as well as on the *ſcleranthus perennis.* It is a native of ſome other northern countries as well as Poland; though formerly the greateſt quantity of it uſed to be collected there. Towards the end of June the *coccus* is in a fit ſtate for gathering. Every one of theſe creatures is then nearly of a ſpherical form, and of a fine violet colour. Some of them, however, are not larger than poppy ſeeds, and others of the ſize of a pepper corn. The males are produced from the ſmall grains, the females from the larger ones; each of them is lodged, in a ſort of cup like that of an acorn. Theſe cups cover more than one half of the body of the animal. They are rough and of a blackiſh brown on the outſide, and ſmooth and ſhining on the inſide. At the roots of ſome of the plants only one or two grains are to be found, at the root of others more than forty are to be met with.

Thoſe who collect the grains have a ſhort ſpade, with which they raiſe the plants from the ground; after the inſects have been collected they replace the plants: the grains are then ſeparated from the earth, which may have adhered to them, by means of a ſieve, and ſprinkled with very cold water or vinegar to prevent them from hatching.

After this they are dried in the ſun, or by gentle artificial warmth; but this muſt be managed with caution as too haſty drying might injure their colour. Sometimes the grains are ſeparated from their covers, and made up into balls.

According to Bernard de Bemith, the Turks and Armenians make uſe of theſe grains not only for dyeing ſilk and wool, but likewiſe the manes and tails of their horſes. The Turkiſh women uſe it for tinging the tips of their fingers. The Dutch formerly mixed it with the true cochineal. The colouring matter extracted from this inſect, by means of a ſolution of alum with the addition of a little chalk, is ſaid to form a lake equal in beauty to that of Florence. The great ſuperiority of the Mexican cochineal, has cauſed the ſcarlet grains of Poland to be neglected in all the countries of Europe where dyeing is beſt underſtood, as they contain not a fifth part of the colouring matter which may be extracted from the real cochineal.

cacti. Body depreſſed, downy, and tranſverſely wrinkled; abdomen purpliſh; legs ſhort and black; antennæ ſubulated, the third part of the length of the body. 22. A native of South America, on the *cactus coccinillifera.* The male is very ſmall; its body is long, of a deep red colour; two long diverging threads proceed from the extremity of the abdomen; its wings are large, white, and incumbent; its legs are pretty long; the antennæ are nearly the length of the body.

The female is more than double the ſize of the male, when

when at its full growth, it is almoſt as large as a pea, of a dark brown colour, and covered with a white powder; the antennæ are ſhort; the body flat beneath, and convex above, and edged with annular ſegments diſtinctly marked; the legs are ſhort.

The female of this inſect is the real cochineal, ſo highly valued in every part of the world, for the incomparable beauty of the red colour which it affords, which forms ſo conſiderable a branch of commerce between the new and old continents. In the year 1736, there was imported into Europe 700,000 pounds weight, worth upwards of 700,000l. ſterling. It was a long while made uſe of before its nature was aſcertained: for a conſiderable time it was thought to be the fruit of ſome vegetable. The ſame opinion prevailed with reſpect to another ſpecies of *coccus*, which was much uſed as a dye before the introduction of the Mexican cochineal, and which, under the name of *kermes*, is collected in Spain, Sardinia, Africa, and Aſia Minor. America is ſtill the only quarter from which the true cochineal is to be obtained. The principal countries, where the cochineal inſects are bred, are Oaxaca, Tlaſcala, Chulula, Nueva Gallicia, and Chiapa, in the kingdom of New Spain; and Hambalo, Loja, and Tucuman in Peru; but it is only in Oaxaca that they are gathered in great quantities, and form a branch of commerce; the cultivation of theſe little creatures being there the chief employment of the Indians. It is imported into Europe, in the form of ſmall irregular grains, flat on the one ſide, and convex on the other: the beſt is of a ſlate gray colour, mixed with red, and covered with a white powder. There are two kinds of cochineal, firſt the fine, called by different names, according to the places from whence it comes, viz *Maſtique*, *Campeſcane*, and *Tetraſcale;* of theſe the maſtique is reckoned the beſt. The ſecond is called *ſylveſter*, from its being commonly collected from a ſpecies of *cactus*, which grows without culture: this is much inferior to the other, both in price and in the quantity of the colouring matter which it affords; it is likewiſe ſmaller, and generally believed to be a different ſpecies of *coccus*. The plant on which they rear the beſt cochineal is called *nopal* by the Indians, (*cactus coccinellifera* of Linnæus). The colour of the cochineal is by ſome ſuppoſed to be derived from the juice of this plant. Its flowers and the juice of its fruit are of a beautiful red colour. The natives of thoſe countries where the cochineal is reared, form plantations of the nopal in ſmall gardens near their houſes; the plant is propagated by cuttings, which grow freely. In about eighteen months after the plantations have been formed they are fit for the reception of the inſects. Theſe plantations muſt be renewed every ſix years, as the inſects ſucceed beſt on young vigorous plants.

The nopal will grow on almoſt any ſoil, and needs no other culture but to be kept clear of weeds, and protected from the north-wind. The inſects are placed upon the nopal about the middle of October, the period at which good weather commonly commences in Mexico after the rains. Thoſe who rear the inſects, take care to preſerve a ſufficient number of females for this purpoſe, either by protecting them during the rainy ſeaſon with a covering of matts, or by removing ſome branches of the nopal loaded with them into their own houſes. Eight or ten of theſe females are put into a ſmall neſt, formed of a tuft of threads collected from a ſpecies of palm, or of any other cottony matter, which is attached to the ſpines of the nopal, on that ſide of the plant expoſed to the riſing ſun, the rays of which promote the hatching of the young inſects, which ſoon proceed in great numbers from the neſt, as each female produces upwards of a thouſand. The larvæ ſpread over the plant, and ſoon fix themſelves by means of their trunk; after this, ſhould they by any accident be diſplaced, they inevitably periſh, as their trunks are broken. In ſome diſtricts the females are preſerved during the rainy ſeaſon in boxes carefully ſhut up. The males live for little more than one month. The females about double that time. Both of them remain in the ſtate of larvæ for about ten days; they remain fifteen days longer in the ſtate of pupæ. The males when they paſs from the ſtate of pupæ get wings; but till that time they are not diſtinguiſhable from the females, except that they are only about half the ſize. After they acquire wings, they impregnate the female, and die. The female, in going through her different changes, does not change her form, but only caſts her ſkin. After ſhe has been impregnated ſhe lives for about a month, and increaſes conſiderably in bulk; then lays her eggs, and dies. According to M. Thierry, there are ſix generations of theſe little animals in the year. They might be collected during the whole year, did not the rainy ſeaſon check their progreſs, and almoſt entirely deſtroy them. According to all the writers on the ſubject, there are three collections made of them yearly. The firſt takes place about the middle of December, and the laſt in the month of May. When they make the firſt collection, they take away the neſts, and pick out the dead females, which had been placed on the nopal the preceding October. The ſecond collection is made when the inſects again begin to produce young. The inſects are detached from the plant with a knife, the edge and point of which have been blunted, to prevent the nopal from being injured. The inſects are received into a veſſel as they are ſeparated from the plant, put to death, and dried. The Indians have ſeveral ways of killing theſe inſects; which they are anxious to accompliſh as ſoon as poſſible, becauſe the females may live for ſome time after they are detached, and produce their young, which might eſcape and diminiſh the quantity of cochineal collected. Some natives put the cochineal in a baſket, and dip them in boiling water; afterwards they expoſe them to the ſun to dry.

Others put them in a hot oven, or on heated plates of iron. But it appears that the beſt cochineal is obtained by following the firſt mode. The different colours imported into Europe depend entirely on the mode of killing the inſects. That which has been killed by dipping in boiling water, loſes part of the white powder, with which they were covered, and acquires a browniſh red colour: this kind is called *renagrida*. That which is killed in an oven retains the white powder, and remains of a gray colour: this is called *jarpeada*. That which is killed by plates of heated iron becomes blackiſh, and is called *negra*.

The dead females which are taken from the neſts which had been put on the nopal, loſe more of their weight in drying than the inſects which are taken off alive and full of young; the firſt loſing three-fourths, and the laſt two-thirds in drying. After it has been dried

it may be kept for any length of time without losing either weight or colour.

It requires much care and attention to preserve these insects from their numerous enemies. The principal enemies which infest the cochineal are, the larvæ of a species of coccinella, which suck them, and leave nothing but the skin. A caterpillar of about an inch long, and of the thickness of a crow quill, is their most destructive enemy, which would soon destroy the whole race, were they allowed to carry on their depredations without molestation. The larvæ of a species of *ptinus* feeds on them likewise. There is a species of insect which lives on the nopal in great numbers, and does as much injury to the plant as the cochineal insects themselves do; which pinches their body, prevents them from taking nourishment, and causes them to drop from the plant. A small mouse which always prefers the fine cochineal to the sylvester, because the cottony matter with which the sylvester is more abundantly covered entangles its teeth, also preys on them. Many birds, too, are fond of them, and would destroy great numbers of them, were they not driven away by the owners of the plantations.

The sylvester is smaller than the true cochineal; their bodies are covered with a white cottony matter, and edged all round with hairs. About eight days after they are fixed, the cottony matter and the hairs increase in length, and become so closely attached to the plant, that part of them is commonly left adhering after the insect has been removed. Though these insects commonly feed on a prickly species of *cactus*, which grows wild, the Indians frequently rear them on the nopal, because they are collected from it with much more facility than from the uncultivated species: for the most dexterous workman cannot collect more of the insects in one day than will produce two ounces of cochineal when dry; whereas he can collect from the *cactus coccinellifera* as many as will yield three pounds when dry. There is also another advantage obtained from rearing the sylvester on the nopal which they cultivate in their gardens; the insects become almost as large as the true cochineal, and lose more and more of their cottony covering in proportion to the frequency of their reproduction. The sylvester has been lately introduced into the British settlements in India. The following account of its introduction and comparative value has been published by Mr Nicolas Fontana, who resided for many years in that part of the world.

"The introduction of cochineal into Bengal, which our neighbours had endeavoured to naturalize in their West India possessions, deserves particularly to be marked, as being likely, under proper management, to become not only a new æra in the progressive resources of the company, but an accession of opulence to the British empire: an æra the more remarkable, as, notwithstanding the attempts of government, the design was not accomplished but through accident, the great parent of discovery, which, with never-ceasing influence operates in many ways for the good of mankind.

"After a large plantation of the various species of *opuntia* had been reared at Madras, waiting only the arrival of the insect to make it serviceable, which a long correspondence of thirteen years could not obtain, Dr Anderson's solicitations about it had almost been forgotten; yet though his laborious industry and zeal for his country's interest, had no other reward, the introduction of the cochineal insect into India is entirely owing to his publications on the subject, which fortunately fell into the hands of Captain Nelson, who was then stationed at Madras with the 52d regiment. On the captain's return to India in 1795, the fleet in which he sailed, repaired for refreshment to the port of Rio de Janeiro. In his perambulations a little way out of this town, he was attended as usually by the centinel, when he saw a plantation of opuntia with the insect upon it. This circumstance immediately brought to his recollection the ardent wish for the importation of the insect expressed in the letters he had read at Madras; and he conceived the hope of being able to gratify Dr Anderson's desire, by carrying some to India with him.

"A day or two previous to his embarkation, he took another walk to the place where he had seen the opuntia or nopal. He made bold to ask the cultivators for some of the plant, being curious, he said, in matters of natural history. Having collected several other plants, he wished to have this also. The good people, being the less suspicious as he was in his regimentals, granted his request. They gave him several plants with insects on them, which he carefully carried aboard. Many of these, during the passage to Bengal, which was remarkably long and tedious for such delicate passengers, died. A few insects only remained alive on the last plant, several of the leaves having withered.

"Captain Nelson, on his arrival in Calcutta, sent the survivors to the botanic garden, where they were distributed on the different species of the opuntia. This well nigh frustrated the whole labour. On the China and Manilla species, they were found to die fast. It fortunately occurred to make trial on the indigenous opuntia of Bengal, which is also abundant in many parts of India. On this the insects thrived amazingly; insomuch, that from these few, in the course of four or five months, a quantity had been collected sufficient for distribution among all who wished to try the rearing of them, and several plants upon which the insects were feeding were sent to Madras.

"The novelty and importance of the object promising so speedy and plentiful a harvest of fortune, engaged a multitude of individuals to undertake the business; and this, no doubt, the more readily, as the cultivation of this field of wealth required but very little capital. Many golden dreams were enjoyed by the new planters. All who had a mind were provided with insects; and undertook plantations of opuntia.

"The anxiety and impatience natural to all, who, indulging in ardent expectations, undertake new enterprises, induced some of the planters of nopal to put the insect upon it when the plant had just emerged from the ground. Others, through inattention, kept their insects in places too near to where the opuntia was growing young, which in that tender and premature state was devoured by these creatures when hard pressed by hunger. The unskilful mode of drying was likewise adopted; and some of those persons whose opinions led the multitude, declared in the most decided and positive manner, that the cochineal would never answer, as it would not be found worth the trouble and expence attending the cultivation of it. All these considerations damped in a great measure the ardour of the enterprise.

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Many abandoned the purſuit, and left the inſects to provide for themſelves, after the plants deſtined for their uſe were deſtroyed, wherever they could find nourithment. They were ſeen flying about indiſcriminately on various other plants, and thus perithing; while others rooted out the plantations, and employed the ground for other purpoſes.

"Beſides the diſcouraging circumſtances already mentioned, it was urged that the ſpecies imported into India was the *grana ſylveſtris*, and that the firſt ſpecimens ſent home had been of no value. They had grown lumpy and muſty for want of being properly dried, or thoroughly diveſted of the cottony matter with which the inſect is covered. But ſuppoſing, it was added, that a proper mode of drying and preparing it could be found out, and the cultivation of it brought to the greateſt perfection, it would ſoon overſtock the market, as there is a certain quantity only, and that not very great, which is required for Europe. This would ſoon be ſupplied, and loſs inſtead of gain would accrue to the planters. This exceſs, however, it was farther urged, was to be preſumed only in the caſe of the country being able to ſupply plants ſufficient for the food of the inſect, which was very doubtful on account of its quick reproduction, as it ſends forth a new generation every forty days. Theſe with other objections of leſs force, may eaſily be refuted by any impartial obſerver acquainted with the nature of the climate and ſoil of India, even without any kind of knowledge of agriculture. In ſuch a vaſt extent of territory as that of the Eaſt India Company, and lying under ſuch a variety of climates, it is not ſurely impoſſible, or very difficult, to find a climate and ſoil fitted for the naturalization and rearing the cochineal inſect, and where the plants will grow to proper ſize for affording it food; in the ſame manner as in the diſtricts of Mexico, where the people who take moſt pains, have them growing to ſuch a height as to require ladders to gather the inſects. Such a ſtate of the plant would check the too rapid reproduction of the inſect, and at the ſame time improve its quality; for it is a fact, that the ſylveſter cochineal, when bred upon a full grown nopal, loſes part of its tenacity, and grows to double the ſize of that gathered on gummy plants, and is leſs covered with the cottony ſubſtance.

"The cultivation of cochineal, would in all probability be greatly favoured by the vicinity of a hilly country; ſuch as the Boglepore, Rajahmahl, and Purneah. It can be aſcertained by good authority, that there are already in the Chittagong diſtrict, plantations of large opuntias, which have been growing for two years paſt. Whenever the inſect ſhall be placed on theſe plants, we ſhall ſee cochineal of a very good quality. The nature and habits of the natives ſeem entirely calculated for the employment of gathering the inſect; work that may be done by old men, women or boys.

"As to the drying the inſects, there is no country where the ſun has ſuch influence as in Bengal. The method of drying in the ſun, after ſcalding the inſect in hot water, is that practiſed in Mexico and in Brazil: the inſects collected in wooden bowls are thereby ſpread from them on a hot diſh of earthen ware, and placed alive on a charcoal fire, where they are ſlowly roaſted, till the downy covering diſappears, and the aqueous juices of the animal are wholly evaporated. During this operation, the inſects are conſtantly ſtirred about with a tin ladle, and ſometimes water is ſprinkled upon them, to prevent abſolute torrefaction, which would deſtroy the colour: but a little practice will teach them to remove them from the fire, though ſurely its barbarity ought to prevent its adoption.

"By an eſtimate, made on a large ſcale, of the neceſſary expence that would attend the cultivation of one hundred biggahs of opuntia, it appeared, that after making every poſſible allowance for ground rent, ryots gathering, and an European overſeer, and intereſt on diſburſement at twelve per cent. the quantity produced of *grana ſylveſtris*, during nine months of the year, reckoning it at four ſicca rupees per ſeer of thirty two ounces, would more than treble the capital employed. But if this calculation be juſt in the vicinity of Calcutta, and there is no reaſon to ſuppoſe it otherwiſe, where labour and ground rent is dear; how much would the whole expence of cultivation and preparation be, if transferred to a greater diſtance, and to the other provinces!

"When the inſect has been well dried, it ſhould be packed immediately, as it might otherwiſe be affected by the damp air of Bengal. In this buſineſs the method uſed in Mexico ſhould be followed; which is to put it firſt into a linen bag, covered with a compact net; and then over the whole an ox's hide ſewed ſo cloſely as to render it impervious to water.

"For ſome of the cochineal which I wanted for the purpoſe of making experiments, collected at Entally, two miles from Calcutta, I paid in 1796 ſixteen rupees per ſeer; for the ſame quantity raiſed by another planter the following year eight rupees; and in 1797, I might have bought a great quantity, part of which came one hundred miles from Calcutta, at five rupees per ſeer.

"The improveability of the *grana ſylveſtris*, by attention, will be aſcertained more clearly by the following fact, than by a thouſand arguments. Some merchants, at my recommendation, bought about two hundred pounds of cochineal made at Raſſapuglah, five miles from Calcutta, at five rupees per ſeer. The ſame houſe paid for ſeven mauns, or 280 ſeers, to Mr Stephens at Keerpay, ſeven rupees per ſeer; and I can ſay, that it was the beſt of the ſort that had yet been ſeen in the town, both for its ſize, cleaning and drying.

"Let us now ſuppoſe for a moment, ſuch cochineal as that made at Keerpay, to be the beſt that can ever be obtained at Bengal, and that the above may be within a rupee, more or leſs, the average price. The *grana fina* that is brought to Bengal by way of Manilla, ſells, when abundant, at ſixteen rupees per ſeer, but oftener at nineteen and twenty. The Bengal *ſylveſtris* contains only from $\frac{1}{10}$ to $\frac{1}{20}$ parts of the colouring matter contained in the other; but ſay only one half, ſo that the manufacturer will be obliged to uſe two ſeers inſtead of one, the quality of the colour to be the ſame; even at this rate, the ſilk manufactories at Bengal might be ſupplied with it, with a yearly ſaving. After ſupplying this market, if the quantity be increaſed, there will be a demand for it in the China and Engliſh markets, though only of the ſylveſter kind. Suppoſing it for ever to remain ſuch, by leaving it to the indolent natives only, even this would be a great acquiſition, conſidering the various ways in which it can be employed by the dyers. Beſides, if the prices were immediately to fall, ſo as not to indemnify the preſent freight and inſurance to the private adventurers, how eaſy would it be to reduce the in-

fect to a much ſmaller bulk, by making a lake, and producing carmine no leſs valuable than the *grana fina*.

"The overſtocking of the market, however, with a drug ſo important, and of ſuch extenſive uſe, is not a thing very likely to happen. The manufacturer, whereever he could get it at a low price, would uſe it generally, and ſubſtitute it in the room of other materials for reds, ſuch as madder, red-wood, and others, uſed for woollens, and ſilks; beſides the great varieties of ſhades from ſcarlet and crimſon, down to all thoſe various tints to be obtained by modifications of reagents from cochineal, with a brilliancy, and ſtability, that would ſoon repay the ſmall additional expence that might be incurred by the ſubſtitution.

"It is a thing greatly to be wiſhed, by every citizen and patriot, that the Bengal cochineal may ſoon be brought to ſuch a degree of perfection, and produced in ſuch plenty, as may admit of a reduction of its price ſufficient to induce the calicoe printers in Europe to uſe it more commonly than hitherto, in the dyeing of cotton; which would open a much wider field for its conſumption. As to the ſhyneſs of cotton to the admiſſion of this animal colour, it is not an obſtacle that ought by any means to be conſidered as inſurmountable in the preſent ſtate of chemiſtry, advancing ſo rapidly to farther improvements, and particularly applying with vaſt ſucceſs many of its operations to the art of dyeing. The few unſucceſsful attempts made by manufacturers and chemiſts to fix this colour on cotton, have been defeated more by the dearneſs of the drug, than by any impracticability of the deſign. This exhauſted at once the purſe and patience, both of the artiſt and chemiſt; and precluded that continuation, repetition, and diverſification of experiment, which is neceſſary to the completion of new inventions.

"It was upon cotton that the Spaniards firſt ſaw the cochineal uſed in Mexico; but for want of preparation it produced but a dull crimſon. When ſome of the dried Bengal inſect was ſhewed to the vakeel of the rajah of Napaul, reſiding as miniſter to our government at Calcutta, he ſoon knew it, and declared that it was always uſed in dyeing his country robes and turbans. The opportunity ariſing from the management of a chintz manufactory, induced me to make ſome trials of cochineal in cotton cloth and thread. By theſe it was aſcertained, that the quantity of colouring matter contained in the Bengal cochineal of 1796, compared with the *grana fina*, was from nine or eleven to ſixteen. I then repeated, as far as the chemical reagents to be obtained in India would permit, various experiments of the kind mentioned by Dr Bancroft, in his firſt volume of the Philoſophy of Faſt Colours; and nearly with the ſame ſucceſs, in variety of ſhades, and degrees of permanency. From theſe experiments, there reſulted two conſiderable benefits to that manufactory: the firſt was, that I was induced to make an addition of a certain quantity of powdered cochineal to the morinda root, for the fine cloths and muſlins that were to undergo the boiling proceſs in the vat. The ſecond, I was led to mix with the baſis for printing red (alum), a decoction of cochineal, inſtead of the *turmeric* or red wood, formerly uſed by printers in tracing their deſigns. This laſt ſubſtitute was only boiled in ſimple morinda, and the other with the addition of cochineal. By this proceſs, deep and brilliant reds were obtained, ſuch as had not hitherto been ſeen in Bengal."

The cultivation, therefore, of the cochineal inſect, is an object worthy of all the countenance and care of government. The attempts toward its naturalization ought not by any means to be abandoned; but continued with all perſevering induſtry, and unwearied attention to every circumſtance that may promote ſo important a branch of commerce. For this article we ſend annually immenſe ſums to the Spaniards. Not only might this expence be ſaved to Britain; but, in due time, the reſt of the world might be ſupplied from the Bengal produce of this valuable commodity. It is in the recollection of moſt people converſant with India affairs, how the firſt ſpecimens of indigo ſent home from Bengal were depreciated and rejected. Hence the cultivation of it was obſtructed for ſome years. But when it began to be attended to in 1780, and 1782, by people who were acquainted with the beſt modes of manufacturing it, it was improved with ſuch rapidity that in 1790, ſome of the Bengal indigo was judged to be equal to the Guatimala, and bore the ſame price. The quantity ſent home in the years 1795 and 1796, was far beyond what had ever been imported into the port of London from all the world, and more than is required for the annual conſumption of Europe. The uſe of indigo in the dye-houſe is very circumſcribed, and confined chiefly to the colours of blue and green. It gives alſo a few finer blacks, with lilac grounds; but it cannot, like cochineal, be applied to the various principal colours, as crimſon, ſcarlet, purple, and all the intermediate ſhades.

Body red; antennæ branched; tail furniſhed with two briſtles. 23. A native of India; on the *ficus religioſa* and *indica*. This is the inſect which produces the gum lac. *ficus.*

In the months of November and December, they firſt appear, and traverſe the branches of the trees on which they are produced for ſome time, and then fix themſelves on the extremities of the young branches. By the middle of January, they are all fixed in their proper ſituations, when they appear as plump as before, but ſhew no other ſigns of life. The legs, antennæ, and ſetæ, are no longer to to be ſeen. Around their edges they are environed with a ſub-pellucid liquid which ſeems to glue them to the branch; it is the gradual accumulation of this liquid which forms a complete cell for each inſect, and is what is called *gum lacca*. About the middle of March the cells are completely formed, and the inſect is in appearance an oval ſmooth red bag without life, about the ſize of a ſmall cochineal inſect, emarginated at the obtuſe end, full of a beautiful red liquid. In October and November, we find about twenty or thirty oval eggs, or rather larvæ, within the red fluid of the mother. When this fluid is all expended, the young inſects pierce a hole through the back of their mother, and walk off one by one, leaving their exuviæ behind, which is that white membranous ſubſtance found in the empty cells of the ſtick lac.

Theſe inſects feed on ſome other trees beſides the *ficus religioſa* and *indica* of Linnæus, viz. on the *rhamnus jujuba* (Linn.) and on the *plaſo*, (Hort. Malabar.) The inſects generally fix themſelves ſo cloſe together, and in ſuch numbers, that ſcarcely one in ſix can complete her cell; the others die, and are eaten by various inſects.

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The extreme branches appear as if they were covered with a red duſt, and their ſap is ſo much exhauſted that they wither and produce no fruit; the leaves drop off or turn to a dirty black colour. Theſe inſects are tranſported from one tree to another by birds. It is worth obſerving, that theſe fig-trees exſude, when wounded, a milky juice, which inſtantly coagulates into a viſcid ropy ſubſtance, and when dried reſembles the gum lac.

A red gum is procured by inciſion from the *plaſo*, ſo ſimilar to the gum lacca, that it may readily be taken for the ſame ſubſtance. Hence, it is probable, theſe animals have but little trouble in preparing the ſap of the trees for the conſtruction of their cells.

The gum *lacca* is rarely ſeen on the *rhamnus jujuba*, and is inferior to what is found upon the other trees. This gum, in Bengal, is principally found on the uncultivated mountains on both ſides the Ganges, where it is produced in ſuch abundance, that the markets might be readily ſupplied, were the conſumpt ten times greater than it is.

The only trouble in collecting it is in breaking down the branches. The beſt lac is of a deep red colour; if it be pale and pierced at top, the value diminiſhes, becauſe the inſects having eſcaped, it cannot be uſeful as a dye, though it may anſwer better as a varnith.

Theſe inſects and their cells have been variouſly denominated: viz. *gum lacca*, *lack*, *laçra*, and in Bengal *laſcha*. By the Engliſh, lac is divided into four kinds; viz. *ſtick lac*, *lump lac*, *ſeed lac*, and *ſhell lac*; for which, and their varieties, ſee the article Lac.

The following account of the lac inſect by Dr William Roxburgh, is publiſhed in the Aſiatic Reſearches, vol. ii.

"Some pieces of very freſh looking lac, adhering to ſmall branches of the *mimoſa cinerea*, were brought me from the mountains on the 20th of laſt month. I kept them carefully, and to day, the 4th December, fourteen days from the time they came from the hills, myriads of exceedingly minute animals were obſerved creeping about the lac and branches it adhered to, and more ſtill iſſuing from ſmall holes over the ſurface of the cells: other ſmall and perforated excreſcences were obſerved with a glaſs, amongſt the perforations; from which the minute inſects iſſued, regularly two to each hole, and crowned with ſome very fine white hairs. When the hairs were rubbed off, two white ſpots appeared. The animals, when ſingle, ran about pretty briſkly; but in general they were ſo numerous, as to be crowded over one another. The body is oblong, tapering moſt towards the tail, below plain, above convex, with a double or flat margin; laterally on the back part of the thorax are two ſmall tubercles, which may be the eyes; the body behind the thorax is croſſed with 12 rings; legs ſix; feelers (antennæ) half the length of the body, jointed, hairy, each ending in two hairs as long as the antennæ; rump, a white point between two terminal hairs, which are as long as the body of the animal; the mouth I could not ſee.

"On opening the cells, the ſubſtance that they were formed of cannot be better deſcribed, with reſpect to appearance, than by ſaying it is like the tranſparent amber that beads are made of: the external covering of the cells may be about half a line thick, is remarkably ſtrong, and able to reſiſt injuries; the partitions are much thinner; the cells are in general irregular ſquares, pentagons, and hexagons, about an eighth of an inch in diameter, and a fourth deep; they have no communication with each other: all theſe I opened during the time the animals were iſſuing, contained in one half a ſmall bag filled with a thick red jelly-like liquor, replete with what I take to be eggs: theſe bags, or utriculi, adhere to the bottom of the cells, and have each two necks, which paſs through perforations in the external coat of the cells, forming the fore-mentioned excreſcences, and ending in ſome very fine hairs. The other half of the cells have a diſtinct opening, and contain a white ſubſtance, like ſome few filaments of cotton rolled together, and numbers of the inſects themſelves ready to make their exit. Several of the ſame inſects I obſerved to have drawn up their legs, and to lie flat; they did not move on being touched, nor did they ſhow any ſigns of life, with the greateſt irritation.

"December 5th. The ſame minute hexapedes continue iſſuing from their cells in numbers; they are more lively, of a deepened red colour, and fewer of the motionleſs ſort. To day I ſaw the mouth; it is a flattened point, about the middle of the breaſt, which the little animal projects on being compreſſed.

"December 6th. The male inſects I have found to day. A few of them are conſtantly running amongſt the females moſt actively; as yet they are ſcarce more, I imagine, than one to 5000 females, but twice their ſize. The head is obtuſe; eyes black, very large; antennæ elavated, feathered, about two thirds the length of the body; below the middle an articulation, ſuch as thoſe in the legs; colour between the eyes, a beautiful ſhining green; neck very ſhort; body oval, brown; abdomen oblong, the length of the body and head; legs ſix; wings membranaceous, four longer than the body, fixed to the ſides of the thorax, narrow at their inſertions, growing broader for two thirds of their length, then rounded; the anterior pair is twice the ſize of the poſterior; a ſtrong fibre runs along their anterior margins; they lie flat, like wings of a common fly, when it walks or reſts; no hairs from the rump; it ſprings moſt actively to a conſiderable diſtance on being touched; mouth in the under part of the head; maxillæ tranſverſe.

"To day the female inſects continue iſſuing in great numbers, and move about as on the fourth.

"December 7th. The ſmall red inſects ſtill more numerous, and move about as before; winged inſects, ſtill very few, continue active. There have been freſh leaves and bits of the branches of both *mimoſa cinerea* and *corinda* put into the wide-mouthed bottle with them: they walk over them indifferently, without ſhowing any preference, nor inclination to work nor copulate.

"I opened a cell whence I thought the winged flies had come, and found ſeveral, eight or ten, more in it, ſtruggling to ſhake off their encumbrances; they were in one of theſe utriculi mentioned on the 4th, which ends in two mouths, ſhut up with fine white hairs, but one of them was open for the exit of the flies; the other would no doubt have opened in due time; this utriculus I found now perfectly dry, and divided into cells by exceeding thin partitions. I imagine, before any of the flies made their eſcape, it might have contained about twenty. In thoſe minute cells with the living flies,

flies, or whence they had made their eſcape, were ſmall, dry, dark-coloured, compreſſed grains, which may be the dried excrements of the flies.

ilicis. Shining brown, covered with white down. 6. This inſect is commonly called *kermes grains*, and inhabits the *quercus coccifera* of the ſouthern parts of Europe. Mr Hellot of the French Academy of Sciences, in his Art of Dyeing, chapter 12. ſays it is found in the woods of Vauvert, Vendeman, and Narbonne; but more abundantly in Spain, towards Alicant and Valencia; but alſo in Murcia, Jaen, Cordova, Seville, Eſtremadura, la Mancha, Serranias de Cuença, and other places. In Xicona, and Tierra de Relluc, there is a diſtrict called *de la Grana*, where the people of Valencia firſt began to gather it, whoſe example was followed all over Spain. It has ſome years produced 5000l. to the inhabitants of Xicona. Both the ancients and moderns ſeem to have had very confuſed notions concerning the origin and nature of the kermes; ſome conſidering it as a fruit: this opinion was entertained by Pliny, and by moſt of the ancient naturaliſts; others taking it for an excreſcence formed by the punctures of a particular fly, like the common gall obſerved upon the oak. Tournefort was of this number. Count Marſigli, and Dr Niſoli a phyſician of Montpelier, made obſervations and experiments, with a view of diſcovering its nature, but did not perfectly ſucceed. Two other phyſicians at Aix in Provence, Dr Emeric and Dr Garidel, applied themſelves about the ſame time with greater ſucceſs; they diſcovered the kermes to be nothing elſe than the body of an inſect. About the beginning of March they are perceived on the branches of the *quercus coccifera*, very ſmall; they ſoon fix themſelves and become immoveable, after which they increaſe rapidly in ſize. In April they arrive at their full growth, and are nearly about the ſize of a pea. About the end of May, ſooner or later, according to the warmth of the climate, the huſk appears replete with ſmall eggs, leſs than poppy ſeed. Theſe are properly ranged under the belly of the inſects, progreſſively placed in the neſt of down that covers their bodies. After this it ſoon dies, though it ſtill adheres to its poſition, rendering a further ſervice to its progeny, and ſhielding them from the inclemency of the weather, or the hoſtile attacks of an enemy. In a good ſeaſon they multiply exceedingly, producing from 1800 to 2000 eggs. In Languedoc and Provence the poor are employed to gather the kermes; the women letting their nails grow for that purpoſe, in order to pick them off with greater facility.

The cuſtom of lopping off the boughs is very injudicious, as by this means they deſtroy the next year's harveſt. Some women will gather two or three pounds a day; the great point being to know the places where they are moſt likely to be found in any quantity, and to gather them early with the morning dew, as the leaves are more pliable and tender at that time, than after they have been parched by the rays of the ſun: ſtrong dews will occaſionally make them fall from the trees ſooner than uſual; when the proper ſeaſon paſſes, they fall off themſelves, and become food for birds, particularly doves. Sometimes there is a ſecond collection; but the inſects are commonly ſmaller, and do not afford ſo much colouring matter. The inſects which are produced in the ſpring, are generally found adhering to the bark; thoſe of the ſecond crop are commonly attached to the leaves.

Thoſe who buy up the kermes for exportation, ſpread it on linen, taking care to ſprinkle it with vinegar, to kill the inſects, which cauſes a red duſt to ſeparate from them; in Spain, this is carefully collected, and kept apart by itſelf. After it has been dried, they paſs it through a ſearce and put it up into bags. In the middle of each, its proportion of red duſt is put into a leather bag, which likewiſe belongs to the buyer. The people of Hinojos, Bonares, Villalba, and of ſome other parts in Spain, dry it on mats in the ſun, ſtirring it about, and ſeparating the red duſt, which is the fineſt part; which they ſprinkle with vinegar, and call *paſtil*. The kermes is much in requeſt on the coaſt of Barbary, particularly that which comes from Spain. The people of Tunis mix it with what is brought from Tetuan, for dyeing thoſe ſcarlet caps ſo much uſed in the Levant.

43 ſpecies of this genus, have been deſcribed in the laſt edition of the Syſtem of Nature.

68. Thrips.

Snout concealed within the mouth. Antennæ filiform, of the ſame length with the thorax. Body linear. Abdomen capable of being bent upwards. Wings four, ſtraight, incumbent, narrower than the body, and nearly forming a croſs.

The inſects of this genus leap about very actively on flowers; their feet are veſicular; the larvæ are equally active with the perfect inſect; commonly red.

The elytra yellowiſh; body black. 2. A native of * *phyſapus*
Europe; on compound flowers. It ſhuts up the flowers of the *lotus corniculatus*, and cauſes them to ſwell out; it is very deſtructive to wheat and rye, frequently rendering the ears quite empty.

Eleven ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

III. LEPIDOPTERA.

Wings four, covered with ſmall ſcales laid over one another, like tiles on the roof of a houſe. The mouth furniſhed with a ſpiral tongue. Body hairy.

69. Papilio, *the Butterfly.*

Antennæ thicker towards the points. Moſt frequently they are both clavated and furniſhed with a knob at the extremity. Their wings, when at reſt, are for the moſt part erect. They fly about in the day time.

The butterfly feeds on the nectarious juice of flowers, or on the ſaccharine juice which exudes from the leaves of vegetables. Their larvæ are active, and run about a good deal. They are furniſhed with tentacula and 16 feet; ſome are naked, others covered with prickles, and feed on the leaves of plants. The pupa is naked, and remains torpid for a longer or ſhorter period; frequently adhering to different ſubſtances, by means of threads attached to its middle or head. The perfect inſect is furniſhed with two feelers, but wants jaws, and has

has four or six feet. Their names are frequently taken from the plants on which they feed.

These butterflies which belong to the family of *knights* are, for the most part, furnished with filiform antennæ, and with a tail or long appendix to the wings; the larvæ are commonly variegated, and but few of them are natives of Europe.

Linnæus has arranged the genus of BUTTERFLY into six divisions, and these again into many subdivisions.

1. EQUITES. Alis primoribus ab angulo posteriore ad apicem longioribus quam ad basin; his sæpe antennæ filiformes.	1. KNIGHTS. Those which have their upper wings longer from the posterior angle to the tip, than to the base, and have their antennæ for the most part filiform.
A. *Troes*. Sæpius nigri, maculis ad pectus sanguineis.	A. *Trojans*. Those equites that are generally black, and marked on the breast with spots of a blood-red colour.
B. *Achivi*. Pectora non cruenta, ocello ad angulam ani.	B. *Greeks*. Such as are not marked on the breast with red spots; but have an ocellus at the angle of the wing near the anus.
a. Alis absque fasciis.	*a*. Wings without bands.
b. Alis fasciatis.	*b*. Wings marked with bands.
2. HELICONII. Alis angustis integerrimis, sæpe denudatis; primoribus oblongis, posterioribus brevissimis.	2. HELICONII. Those which have narrow and perfectly entire wings, frequently bare, the upper ones oblong, the under very short.
3. PARNASSII. Alis integerrimis rotundatis.	3. PARNASSII. Those with wings perfectly entire, the upper pair being round.
4. DANAII. Alis integerrimis.	4. DANAII. Wings perfectly entire.
A. *Candidi*. Alis albis.	A. *Candidi*. Wings white.
B. *Festivi*. Alis variegatis.	B. *Festivi*. Wings variegated.
5. NYMPHALES. Alis denticulatis.	5. NYMPHALES. Those with wings notched.
A. *Gemmati*. Alis ocellatis.	A. *Gemmati*. Wings adorned with several ocelli.
a. In alis omnibus.	*a*. on all the wings.
b. primoribus.	*b*. on the upper wings.
c. posterioribus.	*c*. on the under wings.
B. *Phalerati*. Alis absque ocellis.	B. *Phalerati*. Wings without ocelli.
6. PLEBEII. Parvi, larva sæpius contracta.	6. PLEBEII. Such as are small and have contracted larvæ.
A. *Rurales*. Alis maculis obscurioribus.	A. *Rurales*. Such as have their wings marked with obscure spots.
B. *Urbicolæ*. Alis maculis sæpius pellucidis.	B. *Urbicolæ*. Those with transparent spots on their wings.

1. *EQUITES.*

A. *Troes.*

†Wings furnished with a tail.

Wings of the same colour, both on their upper and under surfaces, black; the upper ones marked with a white band, the under with red spots. A native of India; on the *aristolochia*. The white band on the upper wings is composed of eight white half-divided spots. The scarlet spots on the under wings are round and form a double arch. *hector.*

Wings black, both above and below marked with a white band, common to both wings; that on the lower clouded with red. A native of the Brasils. It resembles the *tinctoria*; body black, breast marked with blood-coloured spots. *ascanius.*

Wings of the same colour, both on their upper and under surfaces, black spotted with white; the under ones marked with circular red spots along their edges. A native of India. Head red; antennæ and thorax black; abdomen white, with red bands; wings marked with numerous white spots, the lower part greenish in the middle with a red circular spot at the angle of the tail. *antenor.*

Wings nearly of the same colour on both upper and under surfaces, clouded; the upper wings marked with a yellow spot, the under with a tawny one near the tail. A native of America. The under surface of the lower wings are marked with red and yellow spots. *glaucus.*

Wings black, sprinkled with green and gold dots, and marked with a bluish green band. A native of Tranquebar. Body covered with green and gold specks. Wings black, speckled with white on their under surface. The upper ones ash-coloured at the tip, the under marked with tawny spots along their edges. *palinurus.*

Wings black, the under ones of a shining green, the under surface marked with seven red spots somewhat resembling eyes. A native of America. Body black; abdomen speckled with white; margin of the upper wings variegated with white and black; under ones with a few faint white specks; the margin variegated with white and black, marked with a white dot at the base on the under surface; the tip greenish, with seven round tawny dots surrounded with a black ring, and marked with a small white lateral dot. *philenor.*

Wings black, with a white band; the under surface of the lower wings marked at the base and at the tip with red. A native of America. Thorax marked with an ash-coloured lateral line; breast with an ash-coloured dot on each side; abdomen with an ash-coloured lateral line beneath; upper wings with both surfaces alike; under ones black above, with three scarlet circular spots at the angle of the tail, and five white ones at the margin, brown beneath, marked with red spots at the base, a red line at the inner margin, and three circular spots at the angle of the tail, with four white circular spots on the outer margin. *asius.*

††Wings notched.

Wings notched and silky, the upper ones green on their superior surface, marked with a black spot, the under with six black spots. A native of Amboyna. *priamus.*

This

This is the moſt remarkable ſpecies of this genus, both for its ſize and beauty. Head and legs black; abdomen bright yellow, and the ſides of the thorax variegated with ſcarlet lines.

anchiſes. Wings of the ſame colour on both their upper and under ſurfaces, black; the under wings marked with ſeven oval ſcarlet ſpots. A native of America; on the orange-tree. The larva is prickly, brown marked with white circular ſtripes, and furniſhed with tentacula. They are gregarious. Pupa brown, marked with four projections on its anterior part.

B. *Achivi.*

† *Wings furniſhed with a double tail.*

pyrrhus. Wings brown, each of them marked with a white band, the band on the upper wings as it were halved. A native of South America and India.

eteocles. Wings of a duſky blue, marked on both ſides with a white band, the edges of the under ones green. A native of Africa.

†† *Wings furniſhed with two notched tails.*

iridates. Wings black on their upper ſurface, ſpotted with blue, and marked with a dotted white edge. A native of Amboyna.

pollux. Wings brown; marked with a yellow band on their upper ſurface, and on their under ſurface with a white band and white ſpots. A native of Africa.

††† *Wings furniſhed with two very ſlight tails.*

cecles. Wings ſtriped, with white and yellow, with a white band in the middle; the lower wings marked on their under ſurfaces with a ſtrip of dots reſembling little eyes. A native of Siam. Of a middle ſize, and very tender.

†††† *Wings notched and furniſhed with a tail.*

polycaon. Wings black, marked with a yellow band; the under ſurface of the lower wings marked with tawny blue and yellow circular ſpots. A native of Surinam; feeds on ſome ſpecies of the *althæa.*

xiphares. Wings black, the upper ſpotted with white, the under ones marked with a yellow band. A native of Africa.

††††† *Wings furniſhed with a tail.*

ulyſſes. Wings black, with a blue radiant centre; the under ſurface of the lower ones adorned with ſeven ocelli. A native of Aſia.

agamemnon. Wings black, ſpotted with green; the under ſurface of the lower ones adorned with an ocellus, and with red ſpots. A native of Aſia.

**machaon.* Wings of the ſame colour in both ſurfaces, yellow with a brown edge, marked with yellow circular ſpots, and with a tawny one at the angle of the tail. A native of Europe; on umbelliferous plants, and on rue. The larvæ are ſeldom found in numbers together, are ſmooth and marked with annular ſtrips of green and black, dotted with red; their tentacula are ſhort and yellow. They emit a very diſagreeable ſmell by which they keep off the *ichneumon.* Their pupa is black and yellow. The under wings are adorned with an eye of a yellowiſh-red colour, encircled with blue, which is ſituated at the edge neareſt the extremity of the abdomen. This is the largeſt and one of the moſt beautiful butterflies which Britain produces. It changes into the pupa in July, aſſumes the winged ſtate in Auguſt, and frequents meadows. Sometimes it appears in May.

**podalirius.* Wings nearly of the ſame colour both on their upper and under ſurfaces, marked with brown bands ſet in pairs; the under ſurface of the lower wings marked with a blood-coloured line. A native of Europe and the northern parts of Aſia and Africa. It feeds on different ſpecies of the *braſſica:* Larva ſolitary, yellowiſh dotted with brown; head pale green; pupa yellowiſh dotted with brown, marked with two ſlight projections towards the anterior extremity.

alcibiades. Wings white, the upper ones marked with black bands along the edges, the under ones marked on their ſuperior ſurface with red near the tip. A native of Tranquebar. Head tawny, with a broad black line in the middle; thorax downy and aſh-coloured, marked with two tawny ſpots; abdomen whitiſh, marked on the ſides with a line of black blotches; upper wings greeniſh at the baſe; under ones marked with a black ſpot near the tail, and marginal circular ſpots; tail long, black tipped with white, ſtreaked with black beneath.

†††††† *Wings terminating in a ſlight projection faintly reſembling a tail.*

phidippus. Wings brown, marked on their under ſurfaces with white bands, adorned with two eyes, and with a double eye at the tail. A native of India. The female much larger than the male.

aurelius. Wings brown, black at the tip, ſpotted with white; the under wings on their lower ſurfaces adorned with two eyes. A native of India.

jaſon. Wings; upper ſurfaces brown, under wings with a band marked with ſix green blotches. A native of South America and India.

philoctetes. Wings brown; the under wings marked with two blue ocelli, with black pupills, and three white dots. A native of South America and India. The female has a tuft of long diverging hairs at the end of the upper wings.

nereus. Wings black, marked with a plain green band; the under ſurfaces of the wings are blackiſh. A native of South America and India.

††††††† *Wings notched.*

menelaus. Upper ſurfaces of the wings of a bright blue, the under ſpotted with brown. A native of South America. The larva prickly and yellow, marked with roſe-coloured ſtrips; head brown and feet red. Pupa pale, and has a cylindrical inflected tail.

neſtor. Upper ſurfaces of the wings brown ſpotted with white and blue in the centre; their under ſurfaces adorned with three or four eyes. A native of America.

telemachus. Wings brown; the upper ſurfaces of both have a large radiated diſk, the under ſurface of each marked with ſix eyes. A native of South America.

perſeus. Wings pale blue, and black at the tips, ſpotted with red. A native of Surinam.

achilles. Upper ſurfaces of the wings black, marked with a blue band; the under ones are brown, adorned with three or five eyes. A native of America.

argyrios. Under surfaces of all the wings of blue and silver; the upper wings black on their superior surfaces, marked with two silver bands, and with two brown ones on the under surface; the under wings marked on their superior surface with a broad silver band, and with seven spots of blue and silver. 378. A native of Asia.

†††††††† *Wings faintly notched.*

idomeneus. Wings nearly crenated, and of a dusky blue colour; the under surfaces clouded, and adorned with two ocelli. 45. A native of South America. The larva is reddish, with feathery protuberances set round it in a ring. The pupa is dentated and furnished with two crooked horns at the head.

2. *Heliconii.*

terpsichore Upper wings yellow; under wings of a deeper yellow than the upper, sprinkled with black spots. 55. A native of Asia.

calliope. Wings yellow; the upper marked with three black streaks, and the under with three black bands. 56. A native of South America and India. Tips of the upper wings speckled with white.

polymnia. Wings pale-yellow; the upper ones marked with a bright yellow band, the under with three black bands. 58. A native of South America. Larva yellowish and prickly.

violæ. Wings tawny, dotted with black, and the under ones have a black edge dotted with white. 359. A native of India; on the violet and borrage.

ricini. Wings brown; the upper wings marked on both sides with two white bands. 63. A native of America; on the *ricinus palma christi*; the base of the under wing in the male marked with purple, in the female with blue; the larva green, covered with white hairs.

3. *Parnassii.*

apollo. Wings white, spotted with black; the under wings arched at the base, and adorned with four ocelli on their upper, and fix on their under surfaces. 50. A native of Europe, and feeds on the *sedum telephium*, and the *saxifraga cotyledon*; flies about slowly; the larva solitary, silky, black, and furnished with two tentacula at the back part of its head; all its segments are marked on each side with two red dots. The pupa covered with a slight follicle; oval, bluish, and marked on each side with red dots on the anterior part.

mnemosyne Wings white, with black veins; the upper ones marked with two black spots near their edges. 51. A native of Europe.

* *crataegi.* Wings white, with black veins. 72. A native of Europe; on fruit trees. It is very destructive in gardens and orchards, and emits a fluid of a reddish colour, which has frequently given rise to the reports of showers of blood which are said to have fallen in different places. Larva gregarious; hairy and yellow, green beneath; head black; body marked with three black lines; pupa greenish, with black spots and dots

andromache. Wings of the same colour, both on their upper and under surfaces; the upper ones dusky and naked, the under yellow. 382. A native of New Holland. Head black; feelers yellow; thorax black, with a yellow dot on each side; breast spotted with yellow; posterior margin of the lower wings black, marked with seven yellowish dots.

4. *Danai.*

A. *Candidi.*

Wings black at the tips, marked with two black spots. 75. A native of Europe; on some species of *brassica*. The upper wings in the male are without black spots, and the same happens in the two following species. The larva solitary, dotted with black, and marked with three sulphur-coloured lines; the tail black; pupa pale green, marked with three yellow lines, and three of its segments globular; eggs set in clusters. * *brassicæ.*

Smaller than the preceding species; wings white, upper ones tipt with brown; the female has three brown spots on the upper, and one on the lower pair. 76. A native of Europe; on the turnip and other species of *brassica*; also on the *tropæolum*. Larva green; marked with a bright yellow line on the back, and bright yellow on the sides; pupa greenish, marked with three sulphur-coloured lines. * *rapæ.*

Wings marked on their under surfaces with broad greenish veins. 77. A native of Europe; on several species of *brassica*. * *napi.*

Wings roundish; of a dusky colour at the tips. 79. A native of Europe; on the mustard. * *sinapis.*

Wings white above; the upper ones on their superior surface, black at the edge and tip, which is marked with four white dots; inferior surfaces black, marked at the tips with four yellow spots and a yellow base; the inferior surface of the under wings scarlet, marked with black veins. 881. *discors.*

Wings roundish, brown at the edges; their under surfaces of a grayish yellow spotted with white. 81. A native of Europe; on different kinds of *reseda* and *brassica*; larva covered with bluish hairs, marked with black spots and yellow streaks. * *daplidice.*

Wings round; the centre of the upper ones tawny; the inferior surface of the under ones clouded with green. 85. A native of Europe; on the *cardamine*, *brassica*, and *thlaspis*. Larva solitary; greenish above and whitish beneath. Pupa green, marked with a white line on each side; thorax conical, ascending. * *cardamines.*

Wings yellow, with black tips, and a brown margin; the inferior surface of the under ones marked with a silver dot. 99. A native of Europe, on the *coronilla*; wings sometimes whitish. Larva somewhat hairy; green marked with yellow lines and black dots. *palæno.*

Wings angular and yellow; each marked with a rusty-coloured spot. 106. A native of Europe; on the buckthorn. Commonly flies about in August, though frequently it lies dormant all winter, and appears early in the spring. The male is very often of a sulphur colour; the female white. Larva smooth; and green with a dark line on the back. Pupa in the anterior part turgid, and drawn to a point. * *rhamni.*

B. *Festivi.*

Wings almost, entire, brown with a rusty-coloured band divided at the point. The lower surface of the under wings ash-coloured and adorned, with two ocelli. The larva, green, streaked with red, with two prickles *cassiæ*

on its head, and tail divided. Pupa reddiſh, with ſilvery ſpots. 120.

* *hyperanthus.* Wings entire, of a duſky colour; the lower ſurface of the upper ones adorned with three ocelli, and the inferior ſurface of the under wings with two or three. 127. A native of Europe; is found at the roots of the *poa annua*; the wings ſometimes have ocelli on their upper ſurfaces. Larva ſolitary, hairy, and of an aſh-colour, marked with a black line behind; the tail furniſhed with two little prominences; pupa brown, ſpotted with yellow; and has a bunch on its back.

œdipus. Wings entire; their upper ſurfaces black, without ſpots, the under brown; the upper wings adorned with three ocelli, the under with five. 495. A native of Europe.

* *pamphilus.* Wings perfectly entire and yellow; the upper adorned on their lower ſurface with one ocellus; the under ones aſh-coloured, marked with a band and four faint ocelli. 239. A native of Europe; on the *cynoſurus criſtatus*; in woody meadows. Larva and pupa green; the former marked with a white line, and has two ſmall prominences at the tail.

arcanius. Wings perfectly entire, of a ruſty colour; the upper marked on their inferior ſurfaces with a ſingle ocellus; the under wings with five, the firſt being ſeparated by a band. 242. A native of Europe; in woody meadows. Larva green, marked on the back with duſt-coloured lines, and on the ſides with yellow lines; the tail furniſhed with two little prominences.

Iphis. Wings perfectly entire, brownish; (the upper wings of the female tawny), the lower ſurface of the under ones aſh-coloured and tawny at the tips, adorned with ſix ocelli. 503. A native of Europe; ſomewhat reſembling the laſt.

5. NYMPHALES.

A. *Gemmati.*

* *jo.* Wings angularly notched, tawny, ſpotted with black; each adorned with one ocellus. 131. A native of Europe. Larva gregarious, prickly, black, dotted with white; their hind legs of a ruſty colour. Pupa green, dotted with gold; having ten ſmall projections on the fore part of the body; the tail divided.

* *maera.* Wings notched, brown; the upper marked on both ſurfaces with one ocellus and a half; the under adorned on their ſuperior ſurfaces with three ocelli, and on their inferior with ſix. 141. A native of Europe; on paſture ground. Larva greeniſh, ſomewhat hairy, having two ſmall prominences at the tail. Pupa greeniſh, ſlightly divided, and prickly on the ſides.

* *megæra.* Wings notched, yellow, and marked with brown bands; the upper adorned with one ocellus, and the under with five ocelli on the ſuperior, and ſix on the inferior ſurface. 142. A native of Europe; on paſture ground. Larva hairy, green, ſtripped with white; the tail divided.

* *ageria.* Wings notched, brown, ſpotted with yellow; the upper adorned on both ſurfaces with one ocellus; the under with four ocelli on their ſuperior ſurface, and four dots on their inferior. 143.

phædra. Wings notched, brown on both their ſuperior and inferior ſurfaces; the upper wings adorned with violet-coloured ocelli. 150. A native of Europe; feeds chiefly on the *avena elatior*. Larva gray, with two lines of black dots on its back; tail divided. It remains under ground till it has undergone its metamorphoſis.

B. *Phalerati.*

populi. Wings notched, of a duſky colour, marked with white dots and bands; their inferior ſurfaces yellow, marked with white bands and black ſpots. 162. A native of Europe; on the *populus tremula*. The female marked with a broader white band than the male. Larva prickly, and variegated; head and tail tawny. Pupa yellowiſh, dotted with black.

* *antiopa.* Wings angular, black, with a whitiſh circumference. 165. A native both of Europe and America; on the birch and willow. When it appears in ſpring, the edges of the wings are white, and in the ſummer they become yellow. Larva gregarious, prickly, black, marked with ſquare ruſty-coloured ſpots on the back. Pupa black, marked with ſmall projections and tawny dots.

* *polychloros.* Wings angular, tawny, ſpotted with black; the upper ones marked on their ſuperior ſurface with four black dots. 166. A native of Europe; on fruit trees. Larva gregarious, prickly, blackiſh, marked with a yellow line on the ſides. Pupa of a fleſh colour.

* *urticæ.* Wings angular, tawny, ſpotted with black; the ſuperior ſurface of the upper wings marked with three black dots. 167. A native of Europe; very common on the nettle; ſuppoſed, though often falſely, to be a forerunner of ſpring. Larva gregarious, prickly, brown, variegated with green; the head black. Pupa brown, marked with ſmall projections, and golden ſpots on the neck, and ſometimes entirely of a golden colour. This inſect, and many others of the ſame genus, *p. atalanta*, *polychloros*, *jo*, &c. ſoon after their enlargement from the chryſalis ſtate, diſcharge a few drops of a reddiſh coloured fluid; which in places where they have appeared in great numbers, has had the appearance of a ſhower of blood, and been marked by writers as a prodigy foreboding ſome extraordinary event.

* *C album.* Wings angular, tawny ſpotted with black; the under ones marked on their inferior ſurface with a white C. 168. A native of Europe; on the nettle, willow, and gooſeberry. Larva ſolitary, prickly, and tawny; the back yellow on the fore part, and white behind. Pupa of a fleſh colour, contracted in the middle, dotted with gold.

hyſpſipyle. Wings notched, yellow, variegated with black, and radiated at the tips; the under ones marked with ſeven red dots. 607. A native of Europe; on the *ariſtolochia clematis*. Larva yellow, marked with black, furniſhed with prickles ſet round in a circle; red, with black tips.

* *atalanta* Wings black, ſpotted with white; the upper ones marked with a purple band on both ſides, the under with a purple band along the edge. 175. A native of Europe and America; on the nettle. Larva ſolitary, prickly, green, marked with yellow lines on the ſides. Pupa marked with ſmall projections; blackiſh above, and aſh-coloured below, dotted with gold.

celtis. Wings angularly notched, brown, marked with tawny ſpots and a ſingle white one; the under wings gray on their inferior ſurfaces. 639. A native of the ſouth of Europe. Larva green, marked with white lines, ſpotted with black. Pupa green, marked with white lines.

levana. Wings ſlightly notched, variegated, and reticulated,

on

on their inferior ſurface; the upper ones marked on their ſuperior ſurface with ſome white ſpots. 201. A native of Europe; on the common thiſtle. Larva gregarious, prickly, and black; legs red; head marked with two prickles; pupa furniſhed with ſmall brown projections; thorax yellowiſh below.

* *adippe.* Wings notched, brown, ſpotted with black, adorned on the inferior ſurface with twenty-three ſilvery ſpots. 212. A native of Europe; on the *viola odorata* and *tricolor*: the ſilver ſpots ſometimes, though rarely, change into yellow; larva aſh-coloured or brown, covered with many reddiſh prickles, and marked on the back with a black line, riſing out of a white one; pupa brown, marked with ſilver dots.

6. *Plebeii.*

A. *Rurales.*

cupido. Under wings terminating in ſix ſmall projections, white on their inferior ſurface, marked with ſilver ſpots. 217. A native of America; on the cotton. Larva white, dotted with black.

* *betulæ.* Wings furniſhed with a ſlight tail, the under ones marked with two white ſtreaks. 220. A native of Europe; on the birch and ſloe. Wings of the male marked with tawny ſpots; larva thick, green, marked with two obliquely tranſverſe white lines, and two ſmall furrows on the back; pupa ſmooth, of a ruſty colour.

pruni. Wings ſlightly tailed, brown above, with a red ſpot at the tip of the lower ones; lower wings beneath with a tawny marginal band, dotted with black. 221. A native of Europe; on the plum-tree. Larva thick, green, with a pale lateral line; pupa brown, with a white head.

* *quercus.* Wings ſlightly tailed, bluiſh, beneath aſh-coloured, with a white ſtreak and double tawny dot near the tail. 222. A native of Europe; on the oak. Larva thick above, of a roſe colour; with three lines of green dots. Pupa ſmooth, of a ruſty colour; with three lines of brown dots on the back.

ceraſi. Wings tailed, brown, without ſpots; the inferior ſurfaces marked with a white ſtreak, and tawny circular ſpots; the under wings marked with a black dot. 719. A native of Europe; on the cherry tree.

ſedi. Wings furniſhed with a tail, blue, with a white ſpotted edge, white on their inferior ſurfaces, marked with black ſquare ſpots, and a reddiſh band. 743. A native of Europe; on the *ſedum telephium*. Larva green; marked with a red line on the back. Pupa obtuſe; green on the anterior, and brown on the poſterior part.

cyllarus. Wings entire, and blue with a black edge; beneath of a browniſh colour, adorned with a ſtreak of dots reſembling ocelli; the under wings on their inferior ſurface blue at the baſe. 750. A native of Europe; on the flower of the *aſtragalus* and *melilot*. Larva pale; marked with a red ſtreak on the back, and on the ſides with oblique green lines; head black. Pupa brown, ſpotted with black.

B. *Urbicolæ.*

comma. Wings perfectly entire, ſpreading ſo as to form an obtuſe angle, tawny, marked with a ſmall white line, and with white dots beneath. 256. A native of Europe; the line wanting in the female. Larva of a ſhining red; head black, with a white ſtrip on the collar. Pupa long, cylindrical, and brown.

* *linea.* Wings perfectly entire, ſpreading ſo as to form an obtuſe angle; tawny, with a black margin. 817. A native of Europe; upper wings in the male marked with a ſmall black line on the middle. Larva ſolitary and green. Pupa green; with a very thin covering.

* *malvæ.* Wings notched and ſpreading ſo as to form an obtuſe angle; brown, waved with aſh colour; the upper wings marked with tranſparent dots; the under ones with white dots. 267. A native of Europe; in the *malva* and *althæa*. Larva gray; head black; neck marked with four ſulphur-coloured dots. It draws together the leaves on which it feeds, by threads which it ſpins. Pupa hunch-backed and bluiſh.

876 ſpecies of the butterfly have been deſcribed in the laſt edition of the Syſtem of Nature publiſhed by Gmelin; but a great many more are to be met with in the collections of the curious, which have not yet been deſcribed by any author.

Sphinx, *Hawk-moth.*

Antennæ nearly priſmatic, thickeſt in the middle. Tongue (in moſt ſpecies) projecting. Feelers two, bent back. Wings deflected.

* Legitimæ. *Antennæ ſcaly, Feelers hairy, Tongue ſpiral.*

† *Wings angular.*

* *ocellata.* The under wings reddiſh, adorned with a blue eye. 1. Native of Europe and America; on the *ſpiræa*, willow, and fruit trees; the thorax marked with a ruſty-coloured ſpot, the tongue very ſhort. The larva ſolitary, rough, green, and furniſhed with a tail; marked with obtuſe white ſtreaks, and dotted with yellow ocelli. The pupa is brown, with a black back.

quercus. Wings angularly notched, yellowiſh, marked on the under ſurface with brown bands; the under wings with a red band. 48. Native of Europe, on the oak. The body of the male is aſh-coloured; that of the female brown. The larva ſolitary, furniſhed with a tail, and green; marked on the ſides with oblique white ſtripes, and with reddiſh ſpecks. The pupa a light brown, with reddiſh edges.

* *populi.* Wings dentated, reverſed and gray; the under wings of a ruſty colour at the baſe; the upper ones marked with a white dot. 2. Native of Europe; on the poplar and willow. The larva ſolitary, rough, green, furniſhed with a tail; it is marked on each ſide with a white line, and with white oblique croſs ſtripes. The pupa a duſky gray, and of a ruſty colour behind.

* *tiliæ.* Wings marked with greeniſh bands, and clouded with dark green; the ſuperior ſurface of the upper wings of a yellowiſh brick-colour. 13. Native of Europe; on the lime-tree. The larva ſolitary, rough, green, furniſhed with a tail. It grows ſmaller towards the head, and is marked on the ſides with oblique blood-coloured and yellow ſtripes. The pupa of a duſky brown.

œnothera. Wings irregularly notched, and greeniſh, marked with a dark green band; the under wings tawny, and black at the tips. 54. Native of Europe; on the *œnothera*. The larva ſolitary, brown, and without a tail; marked with blood-coloured ſpecks, and with a black ocellus, the pupil of which is white, on the laſt

segment but one of the abdomen. The pupa is uncovered, and light brown.

nerii. Wings faintly angular and green; variegated with bands of pale or dark green, and yellow. Native of Europe; on the *nerium*. The larva ſolitary, dotted with white, and marked on each ſide of the neck with a blue ocellus. The tail is bent down, and almoſt jointed. The pupa yellow, marked with a black line and black dots on the back.

†† *Wings entire.*

* *convolvuli.* Wings clouded; the under ones faintly marked with bands; the abdomen marked with belts of red, black, and white. 6. Native of Europe; on the *convolvulus*. It ſmells of ambergriſe. Its eyes are very bright. The larva furniſhed with a tail; marked on each ſide with oblique white lines, and dotted with faint *ocelli*. The pupa light brown, furniſhed with a reflected involuted horn.

* *liguſtri.* The under wings reddiſh, marked with three black bands; the abdomen red, ſurrounded with black belts. 8. Native of Europe; on the privet, lilac, aſh, and elder. The larva green, and furniſhed with a tail; marked on the ſides with oblique ſtreaks of a carnation colour towards the anterior part of the body, and white towards the poſterior. The fore part of the body is erect, and it reſts with the feet elevated. The pupa brown; with a tail formed of four ſmall projections.

* *atropos.* The under wings yellow, marked with brown bands; the abdomen yellow, marked with black belts. 9. Native of Europe; on the jeſſamine, potato, and hemp. It is alſo a native of Africa and Aſia; but the variety to be met with there, is double the ſize of that in Europe. It makes a noiſe by rubbing its feelers againſt its tongue. The larva is ſolitary, and lies concealed under ground all day, coming out in the evening to feed. It is yellow dotted with black, and furniſhed with a tail which is bent down; it is marked on the ſides with croſs lines, half blue, half green. The pupa light brown, marked on both ſides with black ſpecks.

* *celerio.* Wings gray, marked with white ſtreaks; the under ones with brown ones, and with ſix red ſpots. 12. Native of the ſouth of Europe; on the vine. The larva is brown, marked on the ſides with two white lines, and with two ocelli on each ſide of the neck. It is furniſhed with a tail. The pupa is of a dark brown before, and of a light brown behind.

* *elpenor.* The wings variegated with purple and green; the under wings red, and black at the baſe. 17. Native of Europe; on the French willow, the balſam, the convolvulus, and the vine. The larva is furniſhed with a tail, and is ſpotted with black; it is alſo adorned with two blue ocelli on each ſide of the neck. The pupa on the anterior part of the body is of a duſky gray, and brown on the poſterior part, marked with dark-coloured ſpecks.

* *euphorbiæ.* Wings gray; the upper ones marked with two green bands; the under with two red bands, with a black ſtreak at the baſe; the antennæ a pure white. 19. Native of Europe; on the *euphorbia*. The larva is furniſhed with a tail, and is black, marked with white; marked with a blood-coloured line on the back, and on the ſides with yellow dots. The pupa light brown, marked with black ſpecks.

** Seſiae. *The Wings entire; the Tail furniſhed with a beard; the Tongue projecting, and terminating abruptly; the Antennæ cylindrical.*

* *ſtellatarum.* The ſides of the abdomen variegated with black and white; the under wings of a ruſty colour. 27. Native of Europe; on the madder, and on the reſt of theſe plants which form the natural order called *ſtellatæ*. The larva is ſpotted with white, and is furniſhed with a blue tapering tail, of a ruſty colour at the tip. The pupa brown.

* *ſuciformis.* The abdomen black, marked with a yellow band; the wings tranſparent, with a black edge. 28. Native of Europe; on the woodbine, and on the ſcabious. The larva is green, marked on the ſides with a yellow line, and furniſhed with a reddiſh horn. The pupa black, marked on the fore part of the body with yellow ſtreaks, and encloſed in a follicle.

* *apiformis.* The wings tranſparent; the abdomen yellow, with black inciſures; the thorax black, marked with two yellow ſpots. 29. Native of Europe; on flowers. The larva on the trunk of the poplar-tree.

ſeſia. The upper wings brown, the under wings tranſparent; the abdomen black, marked with three yellow belts. 102. Native of Europe.

* *veſpiformis.* The wings tranſparent, with a black edge and black band; the abdomen black; the ſecond and laſt ſegments marked with a yellow margin. 31. Native of Europe.

* *tipuliformis.* The wings tranſparent, with a black edge and black band; the abdomen black; the inciſures are alternately marked with a yellow margin. 32. Native of Europe. Feeds on the pith of the common red currant.

*** Zygænæ Fabricii, ſ. Adſcitæ. *The Tongue projecting, and ſetaceous; the Antennæ thicker in the middle.*

* *filipendulæ.* The upper wings blue, marked with ſix red dots; the under wings red with a blue edge. 34. Native of Europe; on the *ſpiræa filipendula*. There is a variety of this ſpecies (β. *peucedani*) diſtinguiſhed by a red belt on the abdomen, which feeds on the *peucedanus*. The larva is thick, of a ſulphur-colour; marked with four rows of black dots, and furniſhed with a tail. The pupa is brown, of a ſulphur-colour in the middle, and marked with brown ſpecks.

pythia. Black; the upper wings green, marked with three oblong blood-coloured ſpots, placed near one another; the under ones red. 106. Native of Europe. The larva hairy and white; the head marked with two lines of black dots; the fore legs are black; the hind legs yellow.

fulvia. Blue; the upper wings green, marked with five red ſpots; the under ones of a blood-colour, and without ſpots. 107. Native of Europe; on the *lotus corniculatus*.

phegea. Greeniſh-black; the wings marked with tranſparent dots, ſix on the upper, and two on the under wings; the abdomen marked with a yellow belt. 35. Native of Europe; on the oak, &c. The larva brown, with reddiſh head and legs; with tufts of whitiſh feathers on the back.

ephlte Blue; the upper wings marked with ſix red dots; the under ones with one red dot; the abdomen girt with a red belt. 36. Native of the ſouth of Europe; on the *medicago*.

medicago. Sometimes the wings are dotted with white, and the base of the upper wings and the abdomen marked with a yellow belt. The larva hairy and yellowish; the head, legs, and two lines on the body, are of a pale yellow colour.

165 species of this genus have been described in the last edition of the System of Nature.

71. PHALÆNA, *Moth.*

Antennæ growing gradually smaller from their base to their tip. Tongue spiral. Jaws none. Shield (in most species) short, and of a horny substance.

Moths fly about at night, have their antennæ composed of many articulations, and commonly pectinated in one or both sexes. They feed chiefly on the nectareous juice of flowers. The larva is active, commonly smooth, and more or less cylindrical, and feeds on the leaves of plants. The pupa remains torpid, is generally cylindrical, sometimes pointed before, sometimes at both ends, and in most instances covered with a follicle.

PHALÆNÆ dividuntur in,

1. BOMBYCES. Larva 16-poda, sæpius pilosa, subcylindrica; pupa apice acuminata; antennis filiformibus, apice acutis; palpis duobus, compressis, reflexis, æqualibus, pilosis, obtusis; lingua spirali, brevi, membranacea, vix exserta, filiformi, obtusa, bifida.

a. *Attacos*, alis patulis.

b. *Bombyces*, alis non patulis.

- α. Alis reversis.
- β. deflexis.
- γ. incumbentibus.
- δ. convolatis.

2. GEOMETRÆ. Larva octo vel decem-poda, pedibus pectoralibus 6, caudalibus 2, et interdum subcaudalibus 2; hirudinem instar incedans, dum quiescitat, erecta, glabra, pupa apice acuminata; antennis filiformibus, articulis obsoletis; palpis duobus æqualibus, reflexis, membranaceis, cylindricis; lingua porrecta, membranacea, setacea, bifida; alis inquiescentibus, ut plurimum patulis, horizontalibus.

a. Alis angulatis, antennis ut plurimum pectinatis.

b. integris.

c. rotundatis.

3. TORTRICES. Alis obtusissimis, fere retusis, margine exteriore curvo; antennis filiformibus; palpis duobus æqualibus, nudiusculis, basi cylindricis, medio dilatato-ovatis, apice setaceis; lingua porrecta, membranacea, setacea, bifida; larva 16-poda, folia, quæ vorat, et intra quæ se recipit, filis contorquente, et connectente.

4. PYRALIDES. Alis conniventibus, in figuram deltoideam forficatam; antennis filiformibus, articulis obsoletis; palpis duobus æqualibus, reflexis, membranaceis, cylindricis; lingua porrecta, membranacea, setacea, bifida; larva 14—16-poda.

5. NOCTUÆ. Larva 16-poda sæpius glabra, pupa apice acuminata, antennis setaceis, palpis duobus compressis, pilosis, apice cylindricis, nudis; lingua porrecta, cornea, setacea, bifida.

MOTHS are divided into,

1. BOMBYCES. Those whose larvæ are generally hairy, nearly cylindrical, and furnished with 16 feet; whose pupa is drawn to a point at the head; and which have their antennæ filiform and sharp at the tip; two feelers, equal, compressed, bent back, hairy and blunt; the tongue spiral, short, membranaceous, slightly projecting, filiform, blunt, and divided at the extremity.

a. *Attacos*, with spreading wings.

b. *Bombyces*, with wings not spreading.

- α. Wings reversed.
- β. deflected.
- γ. incumbent.
- δ. convoluted.

2. GEOMETRÆ. Those whose larvæ are smooth, and have eight or ten feet, six attached to the breast, two to the tail, and sometimes two more near to the tail; moving like a leech, and resting in an erect posture; whose pupæ are pointed at the head; which have filiform antennæ, with faint articulations, two feelers equal, bent back, membranaceous, and cylindrical; the tongue membranaceous, setaceous, divided at the extremity, and projecting; the wings, when at rest, spreading horizontally.

a. Wings angular; antennæ, for the most part, pectinated.

b. entire.

c. round.

3. TORTRICES. Those which have their wings very blunt, with a curved exterior margin; the antennæ filiform; two feelers equal, nearly smooth, cylindrical at the base, dilated in the middle into an oval form, and setaceous towards the tip; the tongue membranaceous, setaceous, divided at the extremity, and projecting; and whose larvæ are furnished with 16 feet, and twist up the leaves on which they feed, by means of threads they spin, into a retreat for themselves.

4. PYRALIDES. Those which have the wings passing over one another, forming a forked figure resembling the Greek δ; the antennæ filiform, with their articulations faintly expressed; two feelers equal, bent back, membranaceous, and cylindrical; the tongue membranaceous, setaceous, divided at the extremity, and projecting; whose larva has from 14 to 16 feet.

5. NOCTUÆ. Those whose larvæ are for the most part smooth, and furnished with 16 feet; whose pupæ are pointed at the head, and have their antennæ setaceous; two feelers compressed, hairy, with naked cylindrical tips; the tongue formed of a horny substance, setaceous, divided at the point, and projecting.

a. Alis

a. Alis patulis.
b. incumbentibus.
α. Thorace lævi.
β. criſtato.
c. Alis deflexis.
α. Thorace lævi.
β. criſtato.

6. Tineæ. Larva 16-poda, ſæpius intra cucullum latente; pupa anterius acuminata; antennis ſetaceis; lingua membranacea, ſetacea, bifida.

a. *Tineæ*, palpis quatuor, inæqualibus; larva ſæpius rebus culinariis, veſtimentis, pellibus, &c. victitante.

b. *Tineæ*, palpis duobus ad medium bifidis, lacinia interiori acutiſſima.

7. Pterophori ſive Alucitæ. Alis digitatis ad baſin uſque fiſſis; antennis ſetaceis; palpis duobus tenuiſſimis, cylindricis, filiformibus, reflexis, nudis, apice ſubulatis; lingua porrecta, membranacea, elongata, ſetacea, biſida; larva 16-poda, ovata, piloſa; pupa nuda apice, ſubulata.

8. Hapiali. Larva 16-poda, ſubcylindrica, ſæpius glabra, radicibus plantarum victitante; pupa folliculata, cylindrica, apice acuminata; antennis brevibus, moniliformibus; palpis duobus æqualibus, obtuſis, compreſſis, membranaceis, reflexis; linguæque bifidæ inter hos rudimento.

a. Wings ſpreading.
b. incumbent.
α. Thorax ſmooth.
β. creſted.
c. Wings deflected.
α. Thorax ſmooth.
β. creſted.

6. Tineæ. Thoſe whoſe larvæ have 16 feet, and moſt commonly lie concealed under a covering; whoſe pupa is pointed at the head; and have the antennæ ſetaceous, the tongue membranaceous, ſetaceous, and divided at the extremity.

a. *Tineæ*, with four unequal feelers; whoſe larva feed on clothes, hides, furniture, &c.

b. *Tineæ*, two feelers divided to the middle, the interior diviſion very ſharp.

7. Pterophori or Alucitæ. Thoſe which have their wings divided to the baſe into ſeveral portions; the antennæ ſetaceous; two feelers, very ſlender, cylindrical, filiform, bent back, ſmooth, and tapering at the tip; the tongue membranaceous, ſetaceous, divided at the extremity, projecting, and very long; whoſe larvæ are oval, hairy, and furniſhed with 16 feet.

8. Hapiali. Thoſe whoſe larvæ are cylindrical, commonly ſmooth, furniſhed with 16 feet, and feed on the roots of plants; whoſe pupa is cylindrical, pointed at the head, and encloſed in a follicle; and have ſhort, moniliform antennæ; two feelers, equal, obtuſe, compreſſed, membranaceous, bent back, and the rudiment of a divided tongue placed between them.

* *Antennæ filiform.*

a. *Feelers compreſſed.*

† *Wings ſpreading.* Attaci.

atlas. Wings curved, of the ſame colour both on their upper and under ſurfaces, variegated with yellow, marked with a tranſparent ſpot; the upper wings have a ſmall tranſparent ſpot joined to the other. 1. Native of Aſia and America; on the orange tree. Each articulation of the antennæ has two projections proceeding from them in oppoſite directions. The larva has hairy tubercles ſet round it in circles. It ſpins a large ball of ſilk, which is unravelled with very great difficulty.

nictitans. Wings of a dark carnation colour; the under ones marked with a ruſty-coloured eye, the pupil of which is tranſparent. 469. Native of Africa. Female larger than the male.

* *pavonia.* Wings round, clouded with gray, and faintly marked with bands, adorned with a long ſemitranſparent ocellus. 7. Native of Europe; on heath, bramble, the roſe, the elm, the willow, and fruit trees. There are three varieties of this ſpecies, *minor*, *media*, and *major*. The antennæ in the male are more diſtinctly pectinated than in the female. The larva is gregarious, and green, having red and yellow hairy tubercles ſet round it in circles. The pupa is blackiſh, with a hole at the top of the follicle, which is elaſtic and acting like a valve.

tau. Wings of a brick colour, adorned with an eye of a violet colour; with a white ſpear-ſhaped pupil. 8. Native of Europe; on the birch. The larva green, marked on the ſides with oblique white ſtreaks, the back covered with knots. The pupa light-brown and hairy.

†† Bombyces. *Wings not ſpreading.*

α. Wings reverſed.

populifolia. Wings of a brick colour, notched, and marked with a great many brown ſpots like creſcents. 485. Native of Europe; on the white poplar.

* *quercifolia.* Wings notched, and of a ruſty colour; the mouth and ſhanks of the legs black. 18. Native of Europe; on graſs, the ſloe, pear tree, apple, and willow. The larva is hairy, of a ruſty colour, with a blue neck, and furniſhed with a ſlight tail. The pupa brown, marked with red bands.

* *rubi.* Wings fawn coloured, marked with two whitiſh ſtreaks on their upper ſurface. 21. Native of Europe; on the bramble and willow. The larva is hairy, black on the under ſide, and of a ruſty colour, marked with black rings on the upper ſide. When young it is covered with a veil of black ſilk. The pupa blackiſh, marked with three yellow rings, and encloſed in a covering of ſilk.

pruni. Wings notched, yellow, and marked with two brown ſtreaks and a white dot. 22. Native of Europe; on the plum. The larva is ſmooth, of an aſh colour, marked with blue lines, and furniſhed with tufts of hair on the neck and along the ſides; the hind legs are ſtretched out, and at a diſtance from one another. The pupa black on the fore part of the body, and of a light brown behind.

* *potatoria.* Wings faintly notched, and yellow, marked with a broad tawny ſtripe, and with two white dots. 23. Native of Europe; on graſs. It produces oblong eggs of a leaden colour, marked at each end with a green ring, and with a green dot in the middle. The larva has a

tail and a creſt, is hairy, and ſpotted on the ſides with white. The pupa of a light brown.

* *quercus.* Wings of a ruſty colour, marked with a yellow ſtreak; the upper wings with a white dot. 25. Native of Europe; on heath, the ſloe, the birch, the willow and oak. The colour of the female is paler than that of the male. The larva is hairy, gray, marked with black rings, and ſpotted with white. The pupa is encloſed in a thick covering of ſilk, is green, and brown on the fore part.

* *laneſtris.* Wings of a ruſty colour, marked with a white ſtreak; the upper wings are white at the baſe, and marked with a white dot. 28. Native of Europe; on the lime tree, the ſloe, and the willow. It produces eggs covered with aſh-coloured wool. The larva is hairy and black; each of its ſegments is marked with three white dots between two red tufted ſpots. It is gregarious, and lives in habitations which it forms for itſelf compoſed of many cells; going out in queſt of food, it returns through parallel holes. The pupa is of a ſulphur colour.

* *vinula.* Wings nearly reverſed, waved and ſtreaked with brown; body white, dotted with black. 29. A native of Europe; on the willow and poplar. Larva ſolitary, green, and brown on the back, on which there is ſituated a turgid prominence; the tail is furniſhed with two briſtles; it diſcharges an acrid fluid from a chink under its head. Pupa brown.

mori. *Silk-worm.* Wings pale, marked with three faint brown ſtreaks, and a brown circular ſpot. 33. Native of China and Perſia; on the mulberry. It was introduced into Europe by Juſtinian. It varies a little in ſize and colour; the wings being ſometimes yellowiſh, ſometimes whitiſh. The larva is furniſhed with a tail, is naked, and whitiſh. The pupa light brown, encloſed in a thick ſilky covering, from which ſilk is manufactured. The firſt perſon who unravelled the cocoons of the ſilk-worm, and manufactured them into ſilk, was Pamphilia, a woman of Coos, the daughter of Latous, (*Vide* Plin. xi. 22.); *ſeu potius Platis filia,* (Ariſtot. Anim. v. 19.)

* *populi.* Brown and whitiſh on the fore-part; the wings browniſh, marked with a whitiſh ſpreading ſtripe, with a ſmall one placed cloſe by it. 34. Native of Europe; on the poplar, and on fruit trees. The larva hairy, and of an aſh-colour, darker on the back; each ſegment is marked with two pairs of red dots. The pupa is brown on the fore part, and reddiſh behind.

veria. Wings yellow (in the female brown), marked with a white dot, and becoming paler towards the tip. 499. Native of Europe; on the ſloe, &c. It depoſits rough eggs in cluſters. The larva gregarious, hairy, and light-brown. The diviſions between the ſegments black, and marked on the ſides with blue ſpots and ſulphur-coloured dots. The pupa yellowiſh.

* *caſtrenſis.* Wings dark-coloured, marked with two pale bands. 36. Native of Europe; feeds on the *piloſella, jacea, millefolium, alchemilla,* and *euphorbia.* It depoſits its eggs in circles round branches. The larva is gregarious, conſuming a great variety of vegetables: it feeds under a web, and frequently ſhifts its quarters: it is hairy, blue, and marked with red lines dotted with black. The pupa is dark coloured.

* *proceſſionea.* Wings of a browniſh aſh-colour: the female marked with one dark ſtripe; the male with three. 37. Native of Europe; on the oak. Of a middle ſize. The larvæ gregarious, hairy, of a browniſh aſh-colour, black on the back, and marked with yellow warts: they move in ſets, differing in number. The ſkin which they caſt excites inflammation when touched.

β. *Wings deflected.*

† *Tongue ſhort.*

‖ *Back ſmooth.*

ruſa. Wings whitiſh, marked on the back with a brown ſpot, and with ſix brown ſpots like creſcents on the lower wings. 508. Native of Europe. The under wings white, with a brown edge; the antennæ pectinated and brown; the legs brown.

* *plantaginis.* Wings black, with white veins; the under wings yellow, with a black edge, and dotted with black. 42. Native of Europe; on the plantane, elm, and hyacinth. The under wings in the female are ſcarlet; but in the north of Europe, frequently white, with a black edge and black ſpots: when caught it emits a yellow drop from its collar. Larva hairy, black, with the back brown.

* *monacha.* Wings white, waved with black, marked with blood-coloured rings between the ſegments of the abdomen. 43. Native of Europe; on the bramble, the willow, the apple, the oak, the larix, and other ſpecies of pine. To theſe laſt it is particularly deſtructive. Larva browniſh aſh-coloured, with red tufts on the back; the ſecond ſegment of its body is marked with a black ſpot of a heart-ſhape. Pupa black.

* *diſpar* Wings marked with ſpots clouded with gray and brown; the wings of the female whitiſh, with black ſtains. 44. Native of Europe; on the oak, the lime, and fruit trees; the peſt of orchards. The female twice the ſize of the male, covers her eggs with balls of duſt. The larvæ feed on a variety of vegetables, are hairy marked with white lines, dotted with blue on the fore part of the body, and with red behind. When touched they excite an itching in the hands. The pupa is marked on the fore part of the body with four black dots; when touched, it rolls itſelf up into a circle.

* *chryſorrhœa.* Wings of a ſnowy-white, a beard of a ruſty colour at the anus. 45. Native of Europe; on the oak and fruit-trees. There is a ſmaller variety of this ſpecies with browniſh wings in India. The female produces yellow eggs, and covers them with a large quantity of tawny-coloured wool. The larva is blackiſh, hairy, gregarious; not confined to one kind of food; marked with two red lines on the back, tufted with white on the ſides. The pupa blackiſh.

‖ ‖ *Back furniſhed with a Creſt.*

* *pudibunda.* Wings of an aſh colour, marked with three brown waved ſtreaks. 54. There is a variety of this ſpecies, *ſcopularis* β. Antennæ pectinated, wings whitiſh, marked with three dark-coloured bands; the under wings white. It is a native of Europe; on the oak, beech, and fruit-trees. The larva is yellow, hairy; the tuft on the tail longer than the reſt, and red; four tufts on the back, white; the head is pale yellow. The pupa is black in the lower part of the body, and a light brown behind, ſpotted with yellow.

* *caſſus* Wings clouded; the poſterior part of the thorax marked with a black band; antennæ lamellated. 63.

A native of Europe; in decayed wood. The larva somewhat hairy, of a carnation colour; the head black, and back of a blood-colour. It was reckoned a delicacy by the Romans, who fattened it with flour (Plin. xviii. 24.). The pupa of a light brown on the fore part of the body, and yellow behind.

ceraria. Wings yellowish, marked with black bands. 1306. A native of Chili; on a kind of *conyza*. The larva is naked, and red, while it undergoes its metamorphosis; it rolls itself up in a kind of wax, at first white and sweet, and afterwards yellow and bitter, which the natives gather in the autumn and put into cakes.

†† *Tongue long.*

a. *Back smooth.*

* *aulica.* The upper wings gray, and dotted with yellow; the under ones tawny spotted with black. 68. A native of Europe; on the *angelica*, nettle, and grass. The larva solitary, black, marked with white warts; on the upper part of the body it is covered with whitish hairs, and underneath with hairs of a rusty colour.

matronula. Wings brown; the upper wings gray, spotted with yellow on their superior surface; the under ones yellow marked with black bands. 92. A native of Europe; on the *artemisia vulgaris*.

b. *Back furnished with a Crest.*

oo. Wings of an ash-colour, streaked with a light brown, and marked with *oo*. 81. A native of Europe; on the oak. Larva naked, of a violet-colour, marked with white lines, and dots.

æsculi. Of a snow white colour; wings marked with a great number of bluish-black dots; the thorax with six. 33. A native of Europe; in the wood of the pear and horse-chesnut. Larva yellow, dotted with black; head and tail black.

γ. *Wings incumbent.*

**graminis.* Wings gray; marked with a white line dividing into three branches, and a white dot. 73. A native of Europe; on grass. It varies in size, and is very destructive to pasture grounds. The larva consumes all kinds of grass except the *alopecurus*. It is smooth, dusky, with a lateral and dorsal yellow stripe. It is destroyed by rooks and hogs. The pupa remains torpid for fourteen days only.

**fuliginosa* Wings dark-coloured, tinged with red, marked with a double black dot; abdomen red; and black on the back. 95. A native of Europe; on the turnip, mustard, grass, and birch-tree. The larva is hairy, of a rusty colour, with black head and fore-legs; wanders over the snow in winter in Norway; and is said to forbode a cold summer and scarcity where it appears in considerable numbers. Pupa black, marked with yellow bands behind.

varella. Wings transparent and gray; antennæ brown. 591. A native of Europe; on the *vicia sylvatica*. The female deposits her eggs while in the pupa state, and never becomes a perfect insect.

δ. *Wings convoluted.*

bifaria. Wings tawny, marked with numerous white spots, surrounded with blue. 593. A native of the island of Tobago. Feelers white at the base, and tipt with black; thorax bluish black with white dots, and two tawny spots; abdomen beneath white with black rings; anus tawny; upper wings blue at the tip, with white dots; lower wings, and all beneath, black; the hind margin a little whitish.

§§ *Feelers cylindrical.* Geometræ.

a. *Wings angular.*

Wings green and faintly notched, marked with a faint waved whitish streak; a smaller line of the same description being placed contiguous to it. 199. A native of Europe; on thyme. Larva dark-coloured, marked with carnation-coloured spots on the back; the head and collar furnished with two little projections. Pupa light brown, marked with a black line, sharp-pointed before, and divided behind, and covered with a very thin follicle. *thymiaria.*

Wings ash-coloured, and marked with a rusty-coloured streak, and transverse row of black dots. 200. A native of Europe; on the oak. Larva ash-coloured, marked with yellow spots on the sides. Pupa of a pale carnation-colour above, beneath yellow; and is attached to a leaf. *punctoria.*

b. *Wings entire.*

Wings green, somewhat waved, marked with a waved streak, and smaller streak of the same description contiguous to it. 225. A native of Europe; on birch-trees. Larva green, with ten crooked reddish prickles on the back. Pupa green, varied with yellow; remains torpid for 14 days. *papilionaria.*

Wing purple, marked with a pale fillet. 654. A native of Europe. *vittata.*

c. *Wings round.*

All the wings yellowish, marked with brown streaks, and very small dots. 214. A native of Europe; on the *centaurea*. Larva gray, and smooth, marked with a number of interrupted lines of a rusty colour, having two tubercles on the posterior part of the body. **atomaria.*

Wings white, marked with a striated yellow band; the abdomen yellow dotted with black. 213. A native of Europe; on the elm and plane tree. Larva green marked with black lines; head and tail black. Pupa bluish. * *pantaria.*

Wings variegated with green and ash-colour, marked with two black streaks; the anterior one curved, the posterior one waved. 633. A native of Europe; on lichens. Small. Larva rough, varying in colour according to the colour of the lichen on which it feeds, green, ash-coloured, or yellow, spotted with black on the sides; the fore-legs marked with a black spot, and a green dot. *lichenaria.*

§§§ *Feelers almost naked, and cylindrical at the base; dentated in the middle, and oval; tapering at the tips.* Tortrices.

The upper wings green, marked with two oblique yellow streaks; the under wings white. 235. A native of Europe; on the alder and oak. Larva and pupa green: the former is marked along the side with a yellow line, and has the second segment of the back marked with tubercles; the latter marked on the back with a black line. *prasinaria.*

Wings

pomona. Wings clouded, the under ones marked with a reddiſh golden ſpot. 401. A native of Europe; on the apple. Larva naked, and red; with a black head. Pupa light brown.

reſinaria. Wings brown, marked with a brown ſpot at the baſe, common to both wings, and with a triangular ruſty ſpot at the tips. 406. A native of Europe. It takes up its habitation in a ball of roſin, which exudes from a wound made in the branches of the pine. Larva naked, and yellowiſh; head light brown. Pupa brown.

§ § § § *Wings ſhutting cloſely, with the under edge of one over the upper edge of the other.* Pyralides.

farinalis. Feelers bent backwards; wings yellowiſh and poliſhed, marked with white waved ſtreaks, yellowiſh at the baſe and tips. 327. A native of Europe; in flour and meal. It walks with its tail erect.

* *pinguinalis.* Feelers bent backwards; wings aſh-coloured, thicker at the edges, faintly marked with black bands. 336. A native of Europe; on butter, bacon, &c. Very common in houſes and kitchens, ſometimes in the human ſtomach; the moſt pernicious of all the animals that live within the bodies of others. The larva ſmooth, brown, ſhining. Pupa naked, of a light brown.

ſcalis. Wings gray, ſtreaked with brown, and marked with a kidney-ſhaped ſpot, on which there is inſcribed a Roman A. 338. A native of Europe; within the ſtalks of rye, which it conſumes within the ſheath, going from one to another: this is the cauſe of the ears becoming white and empty. Larva green, marked with three longitudinal green lines; head light brown.

* * *The Antennæ ſetaceous.*

§ *Tongue projecting and horny.* Noctuæ.

a. *Wings ſpreading.*

adora. Wings notched, brown, and waved with black; the upper wings are adorned with a black eye, and marked with a blue ſpot like a creſcent, and with a white ſpotted ſtreak. 11. A native of Surinam.

ſtrix. Wings of the ſame colour, both on the upper and under ſurface, reticulated and clouded with black and white. 82. A native of South America. Larva naked, black, and marked on the ſides with a greeniſh line, and with green rings.

macrops. Wings indented; brown, waved with black; upper pair adorned with a large light brown eye. 968. A native of China. In ſome ſpecimens, probably the females, the outer margin of the lower wings is reflected, forming a pouch which contains a great quantity of fine ſilk.

b. *Wings incumbent.*

α. *Thorax ſmooth.*

livida. Wings ſhining black; under wings of a ruſty colour, edged with dark brown. 999. A native of Europe. Larva growing ſmaller towards each end, naked, greeniſh, variegated with yellow, and ſhining red, marked with a dark-coloured line on the back, and with a very ſlender pale one on the ſides; the head of a pale colour.

β. *The Thorax furniſhed with a Creſt.*

typhæ. Wings white, ſtreaked with dark brown, dotted with black on their poſterior margin. 1005. A native of Europe; on the ſtalks of the *typha anguſtifolia*. It comes forth in Auguſt, about the ſize of *pinguinalis*, ſmooth and whitiſh. Larva is gray and naked. It undergoes its metamorphoſis within the ſtalks, in the month of July.

* *ſolani.* Wings variegated with green and gray; the under ones reddiſh, marked with a band near the edge. 1009. A native of Europe; on the potato and bean, devouring the larvæ of other inſects. Larva thick; wrinkled, and of an aſh-colour. Pupa naked, and of a light brown.

C. nigrum. Wings browniſh gray, marked with a black ſpot; white on the outer edge, and with a black line at the tip. 162. A native of Europe; on the common ſpinach. Larva variegated with gray and dark brown, marked on the ſides with black croſs lines, and with a ſingle pale one.

c. *Wings deflected.*

α. *Thorax ſmooth.*

trapezina. Wings whitiſh, marked with a very broad band of a darker colour, dotted with black along the edge. 99. A native of Europe on the hazel. Larva greeniſh, marked with aſh-coloured, whitiſh, and ſulphur-coloured lines: it devours the larvæ of other inſects, and even of its own ſpecies. Pupa of a light brown; it lies dormant for four weeks.

lucernea. Wings aſh-coloured, without ſpots, marked with three whitiſh waved ſtreaks; the collar divided. 102. A native of Europe; frequently flying into candles, whence it has received its name; though many moths are attracted by the light, as well as this.

β. *Thorax furniſhed with a Creſt.*

* *piſi.* Wings aſh-coloured; the upper wings marked at the baſe with a black line, and black characters; legs without ſpots. 135. A native of Europe; on the alder, oak, and fruit trees; varying in the number and figure of the characters. Larva hairy; back yellow; the ſides ſpotted with black and red; a black erect horn on the thorax.

turca. Wings yellowiſh, marked with two dark brown ſtreaks, and adorned with a yellowiſh eye. 140. A native of Europe; on the *juncus piloſus*, and in corn fields under ſtones. Larva reddiſh yellow, black at each end, underneath of a whitiſh yellow, marked on the back with a whitiſh line, and on the ſides with a dark-coloured one; the diviſions between the ſegments are marked with ſmall black lines, and the head is dark brown. It gnaws over the ſtalks of the corn cloſe by the ground, in the months of May and June.

* *oleracea.* The upper wings of a ruſty colour, marked with a yellowiſh ſpot like a creſcent, and with a white line divided behind. 171. A native of Europe; at the roots of cabbage, greens, &c. likewiſe on the leaves of peas and beans. Larva feeds on a variety of vegetables; naked, of a livid colour, dotted with black, and marked on the back with a dark brown line, and on the ſides with a whitiſh one. Pupa naked and blackiſh.

* *piſi.* Wings of a ruſty colour marked with two ſpots, and with

with a pale waved ſtreak on their poſterior part. 172. A native of Europe; on the pea and broom, conſuming their pods. Larva naked, and of a ruſty colour, marked with four yellow lines; head of a carnation colour. Pupa dark brown; the diviſions between the ſegments of a blood colour.

tritici. Of an aſh-colour; the wings marked with two pale-coloured ſpots, and with a ſingle blackiſh one. 179. A native of Europe; on the ears of wheat and oats. Larva naked and yellow; marked with three white lines.

flavicornis. Upper wings of an aſh colour, marked with three black ſtreaks; antennæ yellow. 182. A native of Europe; on fruit trees. Larva naked, greeniſh, marked on the ſides with white dots; head of a carnation colour.

§ § *Tongue prominent and membranaceous.* Tineæ.

a. *Wings four, unequal.*

tenella. Wings gray, emarginated behind; back of a dark brown, and furrowed. 282. A native of Europe; in bee hives, feeding on the wax.

padilla. The upper wings of a livid colour, and marked with 20 black dots; the under ones brown. 351. A native of Europe; on apple trees. The larva gregarious; living in ſwarms, under a common covering: it is naked, and gray, marked with a black dot on each ſide of its ſegments. Pupa yelloviſh.

**pellionella.* Wings gray, marked in the middle with a black dot. 372. It is to be met with everywhere in woollen ſtuffs, which it deſtroys, lying concealed within a covering. Larva whitiſh, marked with a red line on the back. Pupa yelloviſh.

**tapezella* Wings black, under ones whitiſh; head pure white. 371. A native of Europe; on tapeſtry, furs, and ſkins, into which it gnaws holes.

**faſcitella* Wings of an aſh colour; thorax marked on each ſide with a white dot. 373. A native of Europe; in cloths and furs, which it deſtroys. It lies concealed under a covering.

**mellonella.* Wings whitiſh, growing purple towards their exterior part, marked with a white ſtreak; the ſcutellum black, and white at the tip. 375. A native of Europe; in bee-hives, where it penetrates the honey-combs. Larva is naked, and gray, with a light brown head. Pupa light brown.

**proletella.* Wings whitiſh, marked with two dark brown dots; tongue bent inwards. 379. A native of Europe; on different ſpecies of cabbage; on the horned poppy; and on the oak. An individual, in the ſpace of a year, may produce many millions, as they propagate every month, each depoſiting a great number of eggs.

b. *Feelers divided the length of the middle, two in number.*

**granella.* Wings variegated with black and white; head very white. 377. A native of Europe; in granaries, where it deſtroys the grain and collects it into knots; it climbs up the walls of houſes in winter.

§ § § *Wings divided into many diviſions.* Alucitæ.

**didactyla* Wings ſpreading and brown, marked with white ſtreaks; the ſuperior wings bifid; the poſterior ones divided into three diviſions. 454. A native of Europe; on the *geum rivale*, and on the *convolvulus*. Larva green, covered with tufts of hair. Pupa long; with two lines of tubercles on the back, each furniſhed with four prickles.

* * * *Antennæ moniliform and ſhort.* Hepiali.

Wings yellow, with tawny ſtreaks; the wings of the male of a ſnow-white colour. 84. A native of Europe; at the roots of the hop: the hop-planters manure with hogs dung, as a remedy againſt this troubleſome inſect; it depoſits a very great number of eggs. **humuli.*

1529 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

IV. NEUROPTERA.

Wings four; naked; their veins forming a net-work. Tail unarmed.

72. Libellula, *Dragon-Fly.*

Mouth furniſhed with jaws. Jaws numerous. Lip divided into three. Antennæ ſhorter than the thorax; very ſlender and filiform. Wings extended. Tail of the *male* furniſhed with a hooked forceps.

* *Wings ſpreading when the inſect is at reſt.*

A. *The central diviſion of the Lip very minute.*

The under wings marked at the baſe with a blackiſh ſpot; and all the wings marked on the middle of their upper ſurface with a blackiſh ſpot; the abdomen flattiſh and downy. 1. A native of Europe; in waters. **quadrimaculata.*

The under wings becoming black at the baſe; the body quadrangular. 4. A native of Europe; in freſh waters. The one ſex is waved on the back with red, and the other with yellow. **rubicunda.*

All the wings black at the baſe; the abdomen depreſſed; the ſides yelloviſh. 5. A native of Europe; in freſh water. The abdomen of the male bluiſh, marked on the ſides, near the baſe, with yellow ſpots; the abdomen of the female brown, and yellow on the ſides. **depreſſa.*

B. *The diviſions of the Lip equal.* Æſhnæ:

Abdomen yellow, marked with two black lines; the under wings yellow, marked with two black ſpots. 42. A native of China. Small: head yellow; eyes brown; thorax with yellow lines beneath; abdomen with two black lines above, and one beneath; upper ones black at the baſe, with a yellow ſpot. *minuta.*

Thorax black; marked with various yellow characters; tail furniſhed with crooked hooks. 11. A native of Europe. **forcipata.*

* * *Wings erect when the inſect is at reſt; the Eyes diſtant from one another; the exterior diviſion of the Lip ſlightly divided.* Agriæ.

Wings coloured. **virgo.*

a. Body ſhining, greeniſh blue; wings bluiſh in the middle, the baſe and tip whitiſh, the margin without ſpots.

b. Body ſilky; wings bluiſh green, the tip brown, the margin without ſpots.

c. Silky,

c. Silky, green; wings browniſh, with a white marginal dot.

d. Body ſilky; wings brown, gilt with a black ſpot. 20. A native of Europe; about freſh waters.

* *puella.* Wings tranſparent.

a. Body red, with yellow and black lines at each ſegment; wings with marginal ſpots.

b. Body carnation colour; wings with a brown marginal dot.

c. Body alternately blue and aſh-colour; wings with a black dot.

d. Body beneath bluiſh green, above brown; thorax with alternate brown and bluiſh bands; wings with a black marginal dot.

e. Body green, and pale carnation colour; thorax with three black lines; wings with a brown marginal dot. 21. A native of Europe; in almoſt endleſs variety.

This is an extremely ravenous tribe, and are generally ſeen hovering over ſtagnant waters. They copulate in the air, and fly about joined together. They fly very rapidly, and at a greater height than moſt other inſects. The larvæ are ſix-footed; active; inhabitants of the water; furniſhed with articulated pincers, with which they ſeize and prey with the moſt rapacious ferocity on aquatic animals. The pupa reſembles the larva, but has the rudiments of wings.

48 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

73. Ephemera, *Day-Fly.*

Mouth without jaws. Feelers four, very ſhort, and filiform. The reſemblance of a jaw, membranaceous, cylindrical, and connected with the lip. Antennæ ſhort, and tapering towards the tip. Two large ſtemmata above the eyes. Wings erect, under ones very ſmall. Tail briſtly.

Theſe ſhort-lived animals are found everywhere about waters in the ſummer, and in their perfect ſtate ſeldom live above a day, during which time they perform all the functions of life. They remain in the ſtate of larvæ and pupæ for one, two, or three years. The larva lives under water, and is eagerly ſought after by fiſh, particularly by trout, for which it forms an excellent bait. They are furniſhed with ſix feet, a tail, and ſix fins which ſerve them as oars. The pupa reſembles the larva, except in having the rudiments of future wings. They ſcoop out holes for themſelves in the banks of rivers, formed like ſiphons; the one leg ſerving as an entrance, the other as an outlet. The banks of ſome rivers are often perforated with them. When the waters decreaſe, they form freſh holes lower down. The ephemeræ on the Rhine appear two hours before ſunſet; they come forth almoſt all at the ſame time, and in immenſe numbers. Thoſe on the Marne and Seine, in France, do not begin to fly till two hours after ſunſet. The females, by the help of the threads of the tail, and the flapping of their wings, ſupport themſelves on the ſurface of the water, and in almoſt an upright poſition, drop their eggs in cluſters. A female will drop ſeven or eight hundred eggs, which ſink to the bottom.

* *Tail furniſhed with three briſtles.*

Wings reticulated and ſpotted with brown; body brown. 1. A native of Europe; in freſh waters. In the month of June, they are to be ſeen in the evenings flattering about under trees in innumerable ſwarms. In the neighbourhood of Laz in Carniola, they abound ſo much, that the country people collect them for manure; the peaſant who has not collected to the amount of twenty cart loads, thinks himſelf unfortunate. * *vulgata.*

Wings white, the outer margin brown; body black. 3. A native of Europe. * *marginata.*

Wings black, the under ones whitiſh. 4. A native of Europe; in freſh waters. * *veſpertina.*

** *Tail compoſed of the two briſtles.*

Wings white, and reticulated; the head marked with two yellow tubercles. 5. A native of Europe; in freſh waters. The briſtles of the tail white dotted with brown, and longer than the body. * *bioculata.*

Wings white, the edges blackiſh and thicker than the reſt of the wing. 9. A native of Europe; in freſh waters. * *horaria.*

18 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

74. Phryganea.

Mouth furniſhed with a horny mandible, ſhort, arched and ſharp, without teeth. Jaw membranaceous. Feelers four. Stemmata three. Antennæ ſetaceous, and longer than the thorax. Wings incumbent, the under ones folded.

Theſe inſects are ſeen in a ſummer evening floating in the air in great numbers, and are eagerly devoured by ſwallows; they are eaſily diſtinguiſhed from the ſmaller moths, by their wanting the ſpiral tongue. The larva is ſix-footed, found at the bottom of ſhallow waters encloſed in a tube, conſtructed of ſand, ſtraws, or ſmall chips of wood, and is known to fiſhers by the name of *caddy* or *caddo*, who uſe it as a bait for trout, after they have taken off the tube with which it is covered. When about to become a pupa, it ſhuts up the mouth of its tube with a few looſe threads of ſilk, of the ſame nature with that by which it connects the ſtraws and chips that compoſe its tube. The larvæ of the ſpecies which compoſe the firſt diviſion have one or three tails, which ſerve them for fins; the pupæ have ſix feet, and prominent horny jaws. The larvæ of the other ſpecies are ſomewhat hairy, furniſhed with two hooks at the tail, and with three tentacula on the fourth ſegment. The pupa very much reſembles the perfect inſect.

* *Jaw divided. Tail formed of two briſtles, and terminating abruptly.* Semblis.

Wings marked with many veins, forming a net-work. 1. A native of Europe, in freſh waters; carrying about its eggs in a maſs under its belly; body greeniſh. * *bicaudata.*

Body black; wings white, ſpotted with black. 3. A native of Europe. *phalænoides.*

** *Tail without briſtles; the Jaw joined to the lip.*

reticulata. Body black; the wings of a ruſty colour, reticulated with black. 4. A native of Europe.

* *griſea.* Body gray; the upper wings clouded, and marked with a black ſpot on the edge. 6. A native of Europe; in freſh waters. The larva is covered with a tube compoſed of graſs and ruſhes.

* *grandis.* Wings of a browniſh brick-colour, marked with aſh-coloured ſpots. 7. A native of Europe; in freſh waters. The larva is concealed in a cylindrical tube formed of chips of wood.

* *rhombica.* Wings gray, marked with a white rhomboidal ſpot. 8. A native of Europe; in freſh waters. The larva is lodged within a cylindrical tube, formed of bits of graſs, connected together tranſverſely.

50 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

75. Hemerobius.

Mouth furniſhed with a ſhort horny mandible. Jaw cylindrical, ſtraight, and cleft. Lip prominent and entire. Feelers four; projecting, unequal, and filiform. No ſtemmata. Wings deflected, but not folded. Antennæ ſetaceous, projecting, and longer than the thorax, which is convex.

Like the *ephemera*, theſe inſects are very ſhort-lived; and in every ſtate of their exiſtence, they prey with unceaſing avidity upon *aphides*. The larva is ſix-footed, generally oval and hairy. The pupa commonly foliculated. The eggs are depoſited in cluſters on the leaves of plants; each placed on a ſmall ſtalk made of gum. Many of them, when touched, have an excrementitious ſmell. The follicle in which the pupa is encloſed, is of a denſe texture, formed of whitiſh ſilk. In ſummer, at the end of three weeks, the *hemerobius* comes forth a perfect inſect. When the follicle has not been formed till the end of autumn, the pupa remains in it the whole winter; and does not undergo its final metamorphoſis till the enſuing ſpring.

A. *Lip cylindrical, membranaceous, and marked with rings.* Semblides.

* *lutarius.* Black; wings whitiſh, ſtreaked and ſpotted with white. 14. A native of Europe; in freſh waters; very common in the ſpring. It depoſits a great number of light brown eggs, which it attaches in cluſters to the leaves of aquatic plants by means of a glutinous matter.

B. *Lip horny, round at the tip, and arched.*

perla. Yellowiſh green; wings tranſparent, and marked with green veins. 2. A native of Europe; on vegetables. Its eggs are ſet on capillary ſtalks.

mellanoticlos. Yellowiſh; wings tranſparent, variegated with blue and gold, marked with whitiſh veins, dotted, and ſomewhat hairy, the edges marked with very ſmall black dots. 31. A native of Europe.

verſicolor. Yellow; wings tranſparent, variegated with blue and gold; the baſe of the abdomen, the under-part, and anus black; the antennæ yellow. 32. A native of Europe.

31 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

76. Myrmeleon, *Lion-ant*, or *Ant-eater*.

Mouth with a ſharp horny jaw, and mandible. Lip projecting. Feelers ſix. No ſtemmata. Antennæ thicker towards their outer edge. Wings deflected. Tail of the male armed with a pair of pincers, compoſed of two filaments nearly ſtraight.

A. *The poſterior Feelers much longer than the reſt; jaw furniſhed with one tooth; Lip membranaceous and ſquare, terminating abruptly, and emarginated.*

The inſects of this family prey with the moſt ſavage ferocity upon ants, and leſſer inſects; and for the purpoſe of enſnaring them ſink themſelves into the ſand, and form a kind of funnel or pit in which they lie buried, the head only appearing above the ſand: into this hollow ſuch inſects as wander near it are ſure to fall; and not being able to crawl up the ſides of looſe ſand, are ſeized and devoured by the *lion-ant*. But if the ſides of the pit do not give way, or the unlucky inſect appears to be able to make its eſcape, its enemy, by throwing up with its head repeated ſhowers of ſand, forces it down till it comes within its reach. Larva is ſix-footed, oval and hairy, with exſerted toothed jaws. Pupa encloſed in a ball compoſed of agglutinated ſand or earth.

Wings clouded with brown, marked with a white ſpot on their poſterior margin. 3. A native of Europe. The larva goes backwards; frequents ſandy places, where it digs pits to enſnare other inſects. * *formicarius.*

B. *Feelers nearly equal, and filiform; the Jaw fringed; Lip horny, round and entire.*

The upper wings tranſparent, marked at the baſe with a double yellow ſpot; the under wings are yellow, and black at the baſe. 2. A native of Europe. Head black and hairy. *longicornis*

Wings white, marked with a black ſpot at the edge; body variegated. 14. A native of Europe. Variegated with brown and yellow; the antennæ of the ſame length with the body, and black; club oblong. *auſtralis.*

15 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

77. Panorpa, *Scorpion-fly*.

Mouth ſtretched out into a cylindrical ſnout, compoſed of a horny ſubſtance. Mandible, without teeth. Jaw divided at the point. Lip very long, covering the whole mouth, and like it formed of a horny ſubſtance. Feelers four, nearly equal. Antennæ filiform, and longer than the thorax. Tail of the male notched, of the female unarmed.

Wings equal, ſpotted with black. 1. A native of Europe; lives chiefly on dipterous inſects. * *communis.*

Wings tapering towards the point, ſomewhat curved and fringed; female without wings. 3. A native of *hyemalis.*

Europe. It is common when winter diſappears. It is of a browniſh yellow colour above.

10 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

78. Raphidia.

Mouth furniſhed with an arched mandible ſet with teeth. Jaw cylindrical and obtuſe; lip round and entire; all of them formed of a horny ſubſtance, Feelers four, very ſhort, nearly equal, and filiform. Stemmata three. Wings deflected. Antennæ filiform, the ſame length of the thorax, which is lengthened out at the anterior part, and cylindrical. Tail of the female furniſhed with a looſe curved briſtle.

* *ophiopſis.* Wings without ſpots. 1. A native of Europe; in pine foreſts; feeding on other inſects. Larva has ſix feet. The pupa active, very like the perfect inſect in every point, except that it wants wings.

* *notata.* Wings marked on the edge with a brown ſpot. 2. A native of Britain. Black; a reddiſh brown ſpot on the head and legs, and furniſhed with a projecting ſting of the ſame length with the abdomen.

V. HYMENOPTERA.

Wings four, membranaceous for the moſt part. Tail of the female furniſhed with a ſting.

79. Cynips, *Gall-fly.*

Mouth with a ſhort jaw, furniſhed with one tooth, and membranaceous. The mandible arched, cleft at the tip, and with a ſhort, cylindrical, and entire lip, all compoſed of a horny ſubſtance. Feelers four, ſhort, unequal and capitated. Antennæ moniliform. Sting ſpiral, and for the moſt part concealed.

The numerous excreſcences or galls, found on the roots, branches, and leaves of various trees, are produced by the puncture of theſe inſects. The larva is without feet, ſoft, cylindrical, and inhabits within the gall, feeding on the juices of the tree. The pupa reſembles the perfect inſect, except in having only the rudiments of wings.

aſcendens Of a brazen colour; the abdomen conical, aſcending and joined to the trunk by a very narrow connection. 20. A native of Europe. Large; legs of a pale colour; the thighs black at the baſe.

* *roſæ.* Body black; the abdomen of a ruſty colour, and black behind; the legs of a ruſty colour. 1. A native of Bedeguar; on the roſe.

* *quercus baccarum.* Black; baſe of the antennæ and legs yelloviſh. 4. A native of Europe. Forms roundiſh and tranſparent galls, about the ſize of a pea, on the under ſurface of the leaves of the oak; and comes out about the middle of ſummer.

* *quercus foliі.* Black; thorax marked with lines; legs gray; thighs beneath black. 5. A native of Europe. Forms galls about the ſize of a hazel nut, on the under ſurface of the leaves of the oak.

* *quercus infera.* Black; antennæ and legs pale. 6. A native of Europe. Forms globular, opake, red galls, about the ſize of a hazel nut, on the under ſurface of the leaves of the oak.

Black; legs white; thighs brown. 7. A native of Europe. Forms hollow galls, convex at each end, on the footſtalks of the leaves of the oak.

* *quercus petioli.*

Gray; wings marked with a linear croſs. 8. A native of Europe. Forms granulated connected galls, on the male flowers of the oak.

* *quercus pedunculi.*

In galls on the bark of the oak. 9. A native of Europe. Forms a cup-ſhaped gall, the diſk convex and ſurrounded with about twenty concave dots, ſunk into the bark of the oak.

* *quercus corticis.*

Pale; abdomen and eyes black. 10. A native of Europe. Forms white woolly galls on the ſmall branches of the oak.

* *quercus ramuli.*

In the terminal bud of the *quercus robur.* 11. A native of Europe. Found in the large imbricated galls on the terminal buds of the *quercus robur.* This fly is of a very dark green, ſlightly gilded. Its antennæ and feet are of a dun colour, rather deep. It depoſits its eggs in the oak buds, which produce one of the fineſt galls, leafed like a roſe-bud beginning to blow. When the gall is ſmall, the leaves are compreſſed, and lie over one another like the tiles on the roof of a houſe. In the centre of the gall there is a kind of hard nucleus, in the middle of which is a cavity, and in that is found the little larva, which feeds there, takes its growth, undergoes its metamorphoſis, and breaks through the incloſure in order to get out. The whole gall is often near an inch in diameter, ſometimes more when dried and diſplayed, and is attached to the branch by a footſtalk. (Barbut, Inſect. p. 233.)

* *quercus gemmæ.*

On the calyx of the oak and *ægilops.* 18. A native of Europe. Forms galls on the calyx of the *quercus robur*, ſometimes uſed by tanners. They were called by the Romans *cerri.*

quercus calicis.

Black, without ſpots. 12. A native of Europe. Forms galls of the ſhape of a pear, on the upper ſurface of the leaves of the common beech.

* *fagi.*

Body brown. 22. Forms tenacious globular galls, about the ſize of a hazel nut, filled with clear oil, on the branches of the *roſmarinus chilenſis.*

roſmarini.

Body black; the baſe of the antennæ and legs of a brick colour; the abdomen lengthened out into a broad tail. 25. It is lodged at the top of the ſtalk of the *arundo fragmitis*, which becomes dilated, and grows no higher.

phragmitis.

28 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

80. Tenthredo, *Saw-fly.*

Mouth furniſhed with an arched mandible, formed of a horny ſubſtance, and notched in the inſide. Jaw ſtraight and blunt at the tip. Lip cylindrical and divided into three. Feelers four, unequal, and filiform. Wings plain and ſwelling out. Sting compoſed of two ſerrated laminæ, ſlightly projecting. Scutellum marked with two grains placed on its ſurface, at a diſtance from one another.

The male and female of many of the ſpecies of this genus vary in colour. They feed on the leaves of various plants; the female uſes her ſting in the manner of a ſaw, and cuts out ſpaces in the twigs or buds of trees, for the purpoſe of depoſiting her eggs: larva cylindrical, ſoft, with ſixteen or twenty-eight feet; feeds on the leaves

leaves of plants, and when touched rolls itſelf up ſpirally. Pupa encloſed in a follicle, and is very like the perfect inſect; the eggs increaſe in ſize every day till the larvæ burſt from them.

** Antennæ elavated.*

* *femorata.* Antennæ pale yellow; body black; thighs of the hind-legs very large. 1. A native of Europe; on the alder and willow. Larva green, marked on the back with a blue line, and on the ſides with a yellow one.

triſtis. Body black; antennæ pale yellow; wings brown at the tips. 56. A native of the Sundmore iſlands. Larva green, marked on the back with a blue line fringed with black and yellow.

* *vitellinæ.* Abdomen black above, reddiſh on the ſides; the thighs of the hind-legs dentated. 5. A native of Europe; on the birch and willow; the antennæ yellow, and black at the tip. The larva is green, and ſpouts water from an opening a little above the anus.

*** Antennæ without articulations, and thicker towards their outer edge.*

* *enodis.* Antennæ ſmooth: body of a bluiſh black. 11. A native of Europe; on the willow. Larva green, dotted with black, marked on the ſides with a wrinkled yellow line, and furniſhed with an acute tail.

* *uſtulata.* Body black; abdomen bluiſh; ſhanks of the legs pale. 13. A native of Europe; on the *roſa canina.* Wings of a faint ruſty colour, marked with a brown ſpot. Larva green, marked with two white lines; the head of a brick-colour, marked with a dark-coloured band.

cyanocrocea. Head and thorax bluiſh: the abdomen of a ſaffron-colour. 6. A native of Britain; on umbelliferous plants: antennæ black; legs of many colours.

**** Antennæ pectinated.*

cephalotes. Body black; abdomen marked with four yellow belts. 64. A native of Europe; large; head large, three dots ſituated between the eyes; the thorax marked on the fore part with an interrupted yellowiſh ſtreak; legs of a ruſty colour.

* *dorſata.* Body whitiſh; head and back of the thorax and abdomen black. 65. A native of Britain; antennæ black.

***** Antennæ feathered.*

* *pini.* Antennæ ſpear-ſhaped; the thorax ſomewhat hairy. 14. A native of Europe; very common in the fir-tree. The male black; the thighs and ſhanks of the legs of a tawny colour: female twice the ſize of the male; gray; antennæ ſerrated. Larva blue, and of a tawny colour at each end.

****** Antennæ filiform; furniſhed with ſeven or nine articulations.*

* *ruſtica.* Body black; the abdomen marked with three yellow belts; the poſterior pair being interrupted. 16. A native of Europe; on the woodbine. Mouth whitiſh; the ſcutellum and thorax marked with a yellow ſpot; the legs yellow; the knees of the hind-legs black. Larva of an aſh-colour, marked with triangular light brown dots on the back.

Greeniſh yellow; legs tawny; the thighs of the hind-legs of a braſs colour. 69. A native of Europe; in the pods of the vetch; about the ſize of a black ant; the thorax lengthened very much, reſembling a *cynips.* Female bluiſh green, with a metallic luſtre. *cynipiformis.*

Body variegated. 21. A native of Europe; on the poplar and willow. Larvæ feeding in parallel troops; flat, rough, yellow, and marked on each ſide with two rows of black dots; head black. * *ſalicis.*

Body black; head and thorax red. 29. A native of Europe; on the leaves of the alder. When looked at, it attempts to conceal itſelf. The antennæ are black; the abdomen black, with a violet gloſs; the fore-legs reddiſh brown. * *alni.*

Body black; belly, legs, and ſcutellum whitiſh. 35. A native of Europe; on the leaves of the turnip. Small; whitiſh beneath; the edges of the wings black; the edges of the ſegments of the abdomen faint yellow; head and thorax variegated with white. *rapæ.*

Body yellow; head and upper part of the thorax and abdomen black; wings marked with a yellow dot. 55. A native of Europe; on the willow and corinth. The larva yearly deſtroys the gooſeberry and red corinth, but does not injure the black corinth; blue; the three firſt and three laſt ſegments tawny, marked with nine lines of dots. * *capreæ.*

Body black; the ſhanks and apophyſes of the thighs of the hind-legs are white on their exterior ſide. 88. A native of Europe; on the red corinth. The larva deſtroys the edges of the leaves of the red corinth; it is green; the head edged with black; body wrinkled; ſix feet ſituated on the breaſt, are furniſhed with hooks; ſix on the abdomen are ſet cloſe together, and two near the tail reſemble papillæ. *ribis.*

******* Antennæ ſetaceous, compoſed of many articulations.*

Body blue; head red. 40. A native of Europe; on the common pine. Male black; the mouth and ſhanks of the fore-legs pale yellow. * *erythrocephala.*

Black, with a tinge of blue; mouth, feelers, and ſhanks of the legs yellow. 44. A native of Europe; on the poplar; wings brownith; the breaſt variegated with pale yellow on each ſide, edged with bright yellow; the abdomen pale yellow; ſpotted on the back with black. *populi.*

******** The following ſpecies, and other five, ſeem doubtful.*

Black; legs yellow; antennæ ſlightly clavated. 50. A native of Europe; on the leaves of the burdock, the nightſhade, and the *vulvaria;* it is lodged under the cuticle of the leaf; the antennæ ſhorter than the body, tranſparent and deeply articulated; the abdomen oval and pointed. *intercus.*

140 ſpecies of this genus have been deſcribed by Gmelin, in his laſt edition of the Syſtem of Nature.

81. Sirex, *Tailed Waſp.*

Mouth furniſhed with a thick mandible, compoſed of a horny ſubſtance, terminating abruptly at the tip; the

the jaw bent inwards, pointed, cylindrical, and fringed, which, together with the lip, is membranaceous, ſhort and entire. Feelers four; the poſterior ones longer than the reſt, and thicker on the outſide. Antennæ ſiliform, compoſed of upwards of 24 articulations. Sting projecting, rigid, ſerrated. Abdomen cloſely attached to the trunk, terminating in a ſharp point. Wings lance-ſhaped and plane.

The larvæ of this genus are ſix-footed, ſoft, and cylindrical; the head rounded: they perforate wood, and frequently eat their way into the bowels of other inſects and their larvæ, particularly caterpillars, living upon and conſuming their vitals: pupæ foliculated. The perfect inſect lives on the nectar of flowers.

* *gigas.* Body black; the abdomen yellow at the baſe and at the extremity. 1. A native of Europe; on fir trees.

* *ſpectrum* Abdomen black; thorax hairy, with a pale yellow mark before the wings. 3. A native of Europe; in decayed timber, particularly fir wood.

phantoma. Abdomen yellow above, marked with black rings; head and legs pale yellow. 12. A native of Europe; mouth, thorax, and under part of the abdomen black.

18 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

82. Ichneumon.

Mouth furniſhed with a jaw, ſtraight, membranaceous, roundiſh at the tip, divided, expanded, and fringed; the mandible arched, ſharp, and ſmooth; and with a lip cylindrical, membranaceous at the tip, and marginated. Feelers four, unequal, and ſiliform; ſituated in the middle of the lip. Antennæ ſetaceous, furniſhed with upwards of 30 articulations. Sting prominent, furniſhed with a ſheath compoſed of two valves.

The whole of this ſingular genus are paraſitical, deriving their nouriſhment from other inſects. The fly feeds on the nectar of flowers; and when about to lay her eggs perforates the body of ſome other inſect or its caterpillar, with its ſting or inſtrument at the end of the abdomen, and there depoſits them; theſe, after being transformed into larvæ, prey upon the inteſtines of their foſter parents till they are metamorphoſed into pupæ. The larva is without feet, ſoft, and cylindrical; pupa ſometimes naked, ſometimes covered with a follicle. It is a ſpecies of this genus which produces the animal cotton, of which M. Baudry des Lozieres gives an account (Vide *Second Voyage à la Louiſiane, par Baudry des Lozieres*). A worm of conſiderable ſize, which Baudry calls *fly-carrier*, (well known to planters as the *manioc* or indigo worm,) is at one period of the year, attacked by ſwarms of the *ichneumon fly*, which depoſit their eggs in every pore of the worm. The inſects are produced all nearly at the ſame time, and ſpin each of them a minute covering for itſelf. The manioc worm is now covered with a white caſe, which he with conſiderable difficulty ſhakes off, and, in a few days, the inſects are again hatched from it, but in the form of flies, leaving the animal cotton behind them. This production is very abundant, as M. Baudry could collect ſeveral buſhels of it in a ſhort time. In his opinion, it poſſeſſes many advantages over the vegetable cotton.

A. *Scutellum whitiſh; the Antennæ marked with white rings.*

* *raptorius.* Scutellum white; the thorax without ſpots; the ſecond, third, and fourth ſegments of the abdomen pale yellow; the reſt white at the tip. 2. A native of Europe; the thighs of the four hind-legs black.

* *ſeductorius.* Black; the ſcutellum, the extremity of the abdomen, and a notched band on the anterior part of the abdomen, yellow; the legs, and connection between the abdomen and trunk likewiſe yellow. 221. A native of Italy. It forms cells compoſed of cemented clay, in chimneys and windows, arranged commonly in parallel rows, forming a cylindrical neſt, each containing a brown, lucid follicle, in which the larva is lodged, together with the body of a ſpider in which the egg had been originally depoſited. The upper wings are dark-coloured towards the tip.

B. *Scutellum whitiſh; Antennæ totally black.*

equitatorius. Black; the ſcutellum whitiſh; the diviſions between the ſegments black; the ſecond, third, and fourth ſegments, as well as the legs, are yellow. 90. A native of Europe. In the pupa of the *phalæna piniperda*.

* *dimicatorius.* Black; the ſcutellum yellowiſh; the under part of the antennæ reddiſh; the thorax armed on each ſide with a prickle; the abdomen black, marked with yellow belts; anus yellow. 198. A native of Britain.

* *faſciatorius.* Scutellum white; the thorax ſpotted; abdomen black; the baſe of the ſecond ſegment, the third and ſixth ſegments yellow. 93. A native of Britain.

C. *The Scutellum and Thorax of the ſame colour; Antennæ marked with rings.*

migrator. Black; the abdomen of a ruſty colour, and black at the extremity. 116. A native of Europe.

* *obſcurator.* Black; legs reddiſh; the feet of the hind-legs white at the tips. 199. A native of Britain. It ſmells of muſk.

D. *The Scutellum, and Thorax of the ſame colour; Antennæ black.*

denigrator. Body and wings black, marked with a tranſparent ſpot like a creſcent; abdomen ſcarlet. 28. A native of Britain; in gardens.

turionellæ. Black; legs reddiſh; the ſhanks of the hind-legs black, marked with white rings. 40. A native of Europe. In the larva of moths, particularly in the *phalæna turionellæ*. Antennæ of the ſame length with the body; the ſting ſhorter than the abdomen.

* *compunctor.* Black; mouth and legs reddiſh; the abdomen joined to the trunk by a ſtalk, or narrow connection. 33. A native of Europe. In the pupæ of ſome ſpecies of butterfly.

* *jaculator.* Black; the abdomen curved like a ſcythe, reddiſh in the middle; the thighs of the hind-legs clavated; white at the baſe and at the extremity. 52. A native of Europe; in the larvæ of the bee and of the *ſphex*. Having examined with its antennæ, where the ſphex is, and

and having discovered it, it flies away, and returns and places its egg on it.

E. *Antennæ pale yellow.*

venosus. Entirely yellow, except some black between the stemmata; wings white, with yellow veins. 354. A native of Europe.

cinctus. Black; antennæ and legs of a rusty colour; wings transparent, marked with a black speck. 60. A native of Europe; in gardens.

F. *Minute, with the Abdomen closely attached to the Thorax.*

gregarius. Black; the legs and sides of the abdomen of a rusty colour. 204. A native of Europe; in the larvæ of butterflies; gregarious, and very frequent in the spring. Soon after they are hatched they spin each of them a white follicle for themselves, which are connected together in a cluster, from which they come forth perfect insects.

* *bedeguaris.* Shining green; abdomen golden-coloured. 63. A native of Europe; in the larvæ of the *cynips*, which produces the galls on the rose and the oak. The sting the same length with the body.

* *gallarum.* Of a bronze colour; abdomen black; shanks of the legs whitish. 64. A native of Europe; on the larvæ of the *cynips*, which produces the galls on the branches of the oak.

puparum. Body blue and gold; abdomen shining green; the legs pale. 66. A native of Europe; in the larvæ of flies and butterflies.

cynipis. Green and gold; the abdomen brown, marked with a pale-coloured belt at the base; legs yellowish. 68. A native of Europe; on the larvæ of the *cynips*, and on the pupæ of butterflies.

globatus. Black; legs of a rusty colour. 74. A native of Europe; in stalks of grain, within a roundish follicle, composed of white silk, common to a number of the insects.

* *glomeratus.* Black; legs yellow. 75. A native of Europe; in the larvæ of butterflies. Soon after they are hatched, they spin each of them a yellow follicle for themselves; they depofite their eggs on the pupæ of butterflies soon after they have changed from larvæ.

418 species of this genus have been described in the last edition of the System of Nature.

83. Sphex.

Mouth furnished with an entire jaw; the mandible curved, notched, and formed of a substance like horn. Lip horny, and membranaceous at the tip. Feelers four. The antennæ in some species have upwards of 10 articulations. Wings in each sex incumbent and not folded. Sting pungent and concealed within the abdomen.

The insects of this genus are the most savage and rapacious of this class of animals; they attack whatever insects come in their way, and by means of their poisonous sting overcome and devour such as far exceed themselves in size; when they attack any insect, they give one stroke, and fall down as if dead, and quietly wait till the poison they have infused through their sting produce its effect. Their prey either serves as food for themselves or their young. Those of the division B are to be found chiefly on umbelliferous plants; the larva is without feet, soft, and inhabits the body of some other insect, on the juices of which it feeds; the pupa has only the rudiments of wings; the perfect insect deposits her eggs in the bodies of other insects.

A. *Antennæ setaceous; Lip entire; Tongue wanting.* Evaniæ.

Body black; the abdomen very short, and attached to the back part of the thorax by a foot-stalk. 12. A native of Europe, America, and Africa. Sprinkled with concave dots; the thorax flattened behind; the abdomen oval, compressed and very smooth; wings transparent, short, and deflected. *appendigaster.*

B. *Antennæ filiform; the Lip emarginated, and furnished with a bristle on each side; Tongue bent inwards, and divided into three divisions for almost half its length.*

a. *Abdomen attached to the trunk by a stalk or narrow communication.*

Black, hairy; the attachment of the abdomen to the trunk furnished with two articulations; the second and third segments of the abdomen of a rusty colour. 1. A native of Europe; on sandy ground, where it digs a hole with its fore-feet, like a dog, in which it buries the larva of a moth, on which it deposits an egg, and then shuts up the hole. The abdomen exceeds the wings in length about one half, and in the male is black on the back. * *fabulosa.*

Smooth, black; the lip and the edges of the segments of the abdomen lucid. 11. A native of Europe; in holes of wood, in partitions, which have been formed and abandoned by other insects: these it cleanses by gnawing round them; and placing a piece of moist clay at the bottom, sticks a spider upon it. In the body of this spider it deposits its eggs, and then closes up the entrance with clay. The larva is pale, and very like the larva of the bee. Having consumed the spider, which had been enclosed along with it, it spins a yellowish brown membrane for itself, exactly adapted to its body. One female sphex forms a great many nests; she spends no more than two days in forming any one. *figulus.*

Body black; fore-head, mouth, scutellum, and two bands on the abdomen, yellow. 98. A native of Italy; breeds in chimneys and in windows, in the same nest with the *ichneumon seductor*. It is about seven lines long, dotted; the shanks of the legs yellowish, and black at the extremities; wings transparent and dark-coloured at the tips. *insubrica.*

b. *The Abdomen closely attached to the Thorax.*

Downy and black; wings brown; the anterior part of the abdomen of a rusty colour, marked with black belts. 15. A native of Europe; in sandy ground: it digs holes in the sand, in which it buries the larva of a moth, after it has deposited an egg on it. * *viatica.*

Body black; the fore part of the thorax furnished with *spinosa.*

with a prickle on each ſide; the lip and the breaſt of the colour of ſilver. 86. A native of England; ſmooth; wings tranſparent; legs reddiſh.

98 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

84. Scolia.

Mouth furniſhed with a curved ſharp mandible, crenated on the inſide. Jaw compreſſed, projecting, entire and horny. Tongue inflected and divided into three at the tip, very ſhort. Lip projecting, membranaceous at the tip, and entire. Feelers four, equal, ſhort, filiform, and ſituated in the middle of the lip. Antennæ thick and filiform; the firſt joint longer than the reſt.

ſexmaculata. Hairy, black; the abdomen marked with three pair of yellow ſpots. 6. A native of Europe; marked with a yellow ſpot both before and behind the eyes.

quadripunctata. Body black; the abdomen marked with four white dots, the wings of a reddiſh brown. 22. A native of Europe.

27 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

85. Thynnus.

Mouth formed of a horny ſubſtance; the mandible incurved. The jaw ſhort, and ſtraight. Lip longer than the jaw, membranaceous at the tip, and divided into three, the middle diviſion emarginated. Tongue very ſhort and involuted. Feelers four, equal and filiform. Antennæ filiform.

Sentatus. Abdomen black; the ſecond, third, and fourth ſegments marked with two white dots. 1. A native of New Holland. Likewiſe the firſt ſegments are marked with a white dot on the ſides.

13 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

86. Leucopsis.

Mouth compoſed of a horny ſubſtance, and furniſhed with ſhort jaws. The mandible thick, and furniſhed with three teeth at the tip. Lip longer than the jaw; membranaceous and emarginated at the tip. Feelers four, ſhort, equal, and filiform. Antennæ ſhort, ſtraight, and clavated. Thorax furniſhed with a lance-ſhaped ſcale on its under ſide. Sting bent backwards, and concealed in a groove in the upper part of the abdomen.

Cælogaſter. Abdomen attached cloſely to the trunk; ſcale of the thorax half the length of the abdomen. 2. A native of Europe; eyes black; forehead without ſpots; the poſterior part of the thorax marked with a yellow fillet, and without dots. Small than the common waſp.

Three ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

87. Tiphia.

Mouth furniſhed with a membranaceous rounded jaw. The mandible arched, and acute. The lip ſhort, furniſhed with three ſmall projections, and compoſed of a ſubſtance like horn. No tongue. Feelers four, filiform, unequal, projecting, and ſituated in the middle of the lip. Antennæ filiform and arched.

Black; the thighs of the four hind-legs angular and reddiſh. 4. A native of England. **femorata.*

Black; thorax ſpotted; abdomen marked with five yellow bands, the ſecond interrupted. 6. A native of Europe, chiefly in England. **quinquecincta.*

17 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

88. Chalcis.

Feelers four, and equal. Antennæ ſhort, cylindrical, and ſpindle-ſhaped; the firſt articulation a little thicker than the reſt.

Shining black; the thighs of the hind-legs thickened, and marked with a white dot at their extremities. 6. A native of Europe. Feet white. *puſilla.*

7 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

89. Chrysis. *Golden-fly.*

Mouth compoſed of a horny ſubſtance, and projecting; is furniſhed with a linear jaw, and with a lip emarginated, and membranaceous at the tip, and much longer than the jaw. No tongue. Feelers four, projecting, unequal, and filiform. Antennæ ſhort, and filiform; the firſt articulation longer than the reſt. Body gilt and ſhining. Abdomen arched beneath, furniſhed with a ſcale on each ſide. The anus (in moſt of the ſpecies) is furniſhed with ſmall projections. Sting is ſlightly projecting. Wings plane.

The inſects of this genus commonly form their neſts in holes made in walls.

Smooth, poliſhed; the thorax green; the abdomen of a golden colour, and furniſhed with four ſmall projections at the extremity. 1. A native of Europe; in walls. **ignita.*

Smooth, ſhining; the thorax green; the abdomen of a golden colour; the anus furniſhed with two ſmall projections. 4. A native of Europe; in walls. **aurata.*

Smooth, ſhining; the thorax and abdomen blue; the anus furniſhed with three ſmall projections. 5. A native of Europe; in walls. **cyanea.*

Smooth, ſhining green; the thorax and ſuperior part of the two firſt ſegments of the abdomen gilt; the anus furniſhed with four ſmall projections. 6. A native of Europe; in walls of houſes. *viridula.*

27 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

90. VESPA, *Wasp.*

Mouth compoſed of a horny ſubſtance. Jaw compreſſed. Feelers four, unequal, and filiform. Antennæ filiform; the firſt articulation longer than the reſt, and cylindrical. Eyes large and circular. Body ſmooth. Sting pungent, and concealed within the abdomen. The upper wings are folded in the males, females, and neuters.

Theſe live moſtly in numerous ſocieties, conſtructing curious neſts or combs, generally under ground; they prey upon other inſects, eſpecially bees and flies, and devour meal, bread and fruit. The larva is ſoft, without feet, and feeds on the nectar of flowers and honey; the pupa quieſcent, and has the rudiments of wings. Some of them are ſolitary, others live in ſwarms.

A. *No tongue.*

* *The Antennæ thicker towards their outer edge.*

* *crabro.* *Hornet.* The thorax black, marked on the fore part with reddiſh ſpots; there is a double dot contiguous to the diviſions between the ſegments of the abdomen. 3. A native of Europe. It has its neſt in hollow trees, in out-houſes, or any dry ſituation; its combs are very neatly conſtructed, and compoſed of a ſubſtance like coarſe paper, or decayed parchment. They prey on other inſects, particularly on bees. Their ſting is very painful.

* *vulgaris.* Thorax marked on each ſide with a ſmall interrupted line; the ſcutellum marked with four ſpots; the diviſions between the ſegments of the abdomen dotted with black. 4. A native of Europe, about houſes; they prey on flies, and rob bee-hives. They live in ſwarms compoſed of males, females, and neuters. The male has a yellow head, and long antennæ; an abdomen compoſed of ſeven yellow ſegments, marked with black triangular ſpots. They are deſtitute of ſtings, but are longer and larger than the neuters, though ſmaller than the females. The female has ſhort antennæ; lip yellow; abdomen compoſed of ſix ſegments, marked on the ſides with two black dots, and is furniſhed with a ſting. There are frequently between two and three hundred females, and as many males, in a ſwarm of waſps. A ſingle female in the ſpring that had been impregnated in the preceding autumn, lays the foundation of a ſwarm. It makes itſelf a hole in ſome dry ſituation, or fixes on a mole hole, where it haſtily builds a few cells, and depoſits its eggs; which in the courſe of about twenty days, paſs through their different changes, and become perfect inſects. Almoſt the whole of thoſe produced from the firſt depoſited eggs are neuters. As ſoon as they are fit to fly about, they commence their labours, enlarge their hole by removing the earth with their mouth, go out in queſt of materials for forming new cells, which are compoſed of ſmall fibres of wood, cemented together by a glutinous ſubſtance formed within the body of the animal. They may frequently be ſeen on rails, poſts, &c. on reeds, or ſtalks of decayed vegetables, gnawing off ſmall particles which they convey to their neſt, and deliver to thoſe occupied in the conſtruction of the work. The external covering of their neſt is formed of ſeveral layers of thin leaves reſembling paper, which are not in immediate contact with one another, and in that way they prevent external moiſture from penetrating into the cells, which are arranged in flat combs placed one over another, each ſtory being ſupported by a number of very neat pillars. The female continues to depoſit her eggs, which are oblong and yellowiſh, during the whole ſummer, to the amount of many thouſands. A few hundreds of thoſe that are laſt depoſited, produce males and females, which are impregnated in the autumn, and which, ſhould they ſurvive the winter, lay the foundation of new ſwarms in the ſpring. All the neuters and males periſh in the beginning of winter.

Body black; the thorax is marked with two dots; the ſcutellum is likewiſe marked with two dots, the abdomen with five yellow bands, the firſt of which is at a diſtance from the reſt. 6. A native of Europe; about houſes. It forms its neſt in holes in wood. * *parietum*

Black; thorax marked with two pale yellow ſpots; the abdomen marked with four yellow bands, the firſt at a conſiderable diſtance from the reſt. 8. A native of Europe, in walls; the ſcutellum without ſpots; the ſhanks of the legs yellowiſh. * *muraria.*

Firſt ſegment of the abdomen funnel-ſhaped; the ſecond bell-ſhaped, and very large. 11. A native of Europe, in gardens. It attaches its neſt, which is globular, and conſtructed of the ſame materials with that of the common waſp, to the branches of trees; the abdomen black, the ſegments yellow at the edges the the firſt and ſecond marked with two dots. * *coarctata*

* * *Antennæ filiform.* Crabrones.

The abdomen marked with two yellow bands; the anus furniſhed with three ſmall projections; wings black, white at the edge. 98. A native of Europe. *tridentata.*

Thorax without ſpots; the abdomen marked on each ſide with five yellow ſpots; legs black. 101. A native of Europe, in ſandy ſituations. Head large, terminating abruptly in the fore part; mouth of a ſilver colour; the ſpots on the abdomen uniting ſo as to form a band. *foſſoria.*

B. *The Tongue bent inwards, and divided into three at the point.* Bombyces.

The upper lip conical and divided; the abdomen black, marked with waved yellowiſh bands. 152. A native of Europe, on ſand hills. Their neſts contain only a ſingle larva. *roſtrata.*

Black; lip roundiſh; the abdomen marked with ſix yellow bands, the firſt five of which are interrupted. 157. A native of Europe, covered with aſh-coloured down; the thorax ſpotted with brown, the antennæ black, the firſt articulation yellow below, the laſt of a ruſty colour; lip and legs yellow; the thighs black; the anus furniſhed with three ſmall projections. *faſciata.*

The lip nearly conical; the thorax brown, ſpotted with yellow; abdomen black, marked with ſix yellow bands; antennæ and legs of a ruſty colour. 159. A native of Europe; head brown; mouth yellow; the bands on the abdomen broad, the firſt four interrupted. *ruficornis.*

160 ſpecies of this genus have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature.

91.

91. APIS, *Bee.*

Mouth formed of a ſubſtance reſembling horn; the lip and jaw membranaceous at the tip; tongue bent inwards. Feelers four, unequal, and filiform. Wings plane. The females and neuters have a pungent ſting concealed within the abdomen.

The inſects of this genus live ſome of them in large ſocieties, and ſome are ſolitary; their food is the nectar of flowers, honey, and ripe fruit; the larva is ſoft and without feet; the pupa reſembles the perfect inſect. The larvæ of the neuters are very numerous, and placed in hexagonal cells; the larvæ of the males are turgid and obtuſe in the fore part, and tapering behind.

A. *The Tongue divided into five at the point; the Feelers very ſhort.*

**centuncularis.* Black; the under part of the abdomen covered with yellow wool. 4. A native of Europe. It forms ſeveral neſts under ground, very neatly compoſed of the leaves of roſes. There are ſeveral ſpecies which form ſimilar neſts in the trunks of trees or in walls, compoſed ſometimes of the leaves of the roſe, at other times of thoſe of the horſe cheſnut.

**punctata.* Black, covered with aſh-coloured hairs; abdomen black; the ſegments of the abdomen marked on each ſide with a white dot; the ſcutellum entire. 59. A native of Britain, on flowers.

mellifica. *Common Honey Bee.* Downy; the thorax grayiſh; abdomen brown; thighs of the hind legs fringed with hairs; on the inſide marked with tranſverſe ſtriæ. 22. A native of Europe, in hollow trees; but they are more frequently domeſticated, and kept in hives. This well-known and buſy inſect lives in great ſwarms, compoſed of females or queens, males or drones, and neuters or working bees. The female is larger and longer than the reſt, the abdomen being about one-third longer than the wings; the antennæ have ten articulations; the feet reddiſh. The males are larger than the neuters; their wings are longer than the body; their antennæ have eleven articulations; the trunk is covered with long hairs, and is of a tawny colour. The neuters as well as the females are gray on the thorax, and are furniſhed with a ſting, of which the males are deſtitute; their antennæ have fifteen articulations; they are furniſhed with two ſtomachs. A ſwarm conſiſts commonly of one female, from 1000 to 1500 males, and of nearly 20,000 neuters (vide BEE.) They conſtruct regular combs, compoſed of hexagonal cells, with wax which is formed within the body of the inſect. Reaumur and others have ſuppoſed, that the wax was formed from the farina of flowers, which the neuters collect and carry home on their legs, and their opinion has been implicitly followed. But Mr Huber, member of the Society of Natural Philoſophy and Natural Hiſtory of Geneva, by a ſet of very accurate experiments and obſervations, has clearly proven that the wax is formed from honey (vide *Journal de Phyſique*, &c. *Pluviôſe* An. XII.) We ſhall give here his own account of the experiments he has made. "It has been thought ſtrange that the word wax ſhould ſeldom occur in a book which treats of bees alone; but nevertheleſs, as in the courſe of my obſervations I had not attended to the products of their induſtry, I could only have repeated what had been ſaid by Swammerdam and Reaumur, and that did not ſeem to me to be neceſſary. I knew that theſe inſects collected abundantly upon the antheræ of flowers; that they are acquainted with the method of opening them, of gathering their duſt, keeping it in the cavities of their hind legs, and carrying it to their hives. It had been obſerved that the particles of this duſt ſwell in water, and that when one of them burſts, an oily liquor runs out, which floats on its ſurface, but did not mix with it. From theſe experiments, repeated on the duſt of a great number of flowers, it was concluded that they contain the principles of wax; but it was admitted that theſe muſt undergo a peculiar elaboration in the body of the bee, ſince, according to the experiments of Reaumur, a flexible wax could not be made from the duſt of the antheræ. It will be ſeen here from ſeveral paſſages in my work that I had adopted this opinion; a ſingle obſervation of Burnons, (the name of Mr Huber's ſecretary), changed all my ideas. The true origin of wax might have been ſooner known, had there been any ſuſpicion that it was not already diſcovered. I ſhall now ſtate how I was led to doubt, and what I have done to verify my new conjectures.

"I was in Switzerland in 1793: the farmer of the eſtate on which I reſided had many bees; and the greater part of his hives having been ſtocked in former years, the combs with which they were filled reached to the ſtands, conſequently there was no room to conſtruct new ones. We remarked, however, that the working bees carried in a conſiderable quantity of this fecundating powder. There was alſo in the ſame apiary, ſome ſwarms of that year, the hives having only been ſtocked a day or two; in ſome of them the combs were only begun; in others they were larger; but in all of them there were vacancies to fill up, and much work to do. We obſerved with aſtoniſhment, that the bees of theſe ſwarms did not carry in the pollen; and that, nevertheleſs, they worked with activity in the conſtruction of new combs, and in lengthening thoſe already commenced. Where, therefore, did they procure materials for their edifices? After theſe obſervations, we ſuſpected that it was not from the duſt of the ſtamina, and that they had a very different uſe for it than that for which it was believed to be intended. We, however, found that it was impoſſible to explain theſe extraordinary facts, without abandoning the hypotheſis of Reaumur, by ſuppoſing that the bees of the old hives ſtored up ſo much pollen in their combs for their future wants, while thoſe of the new ſwarms did not carry it outwardly on their legs, in the infancy of their eſtabliſhment, becauſe they had no cells in which they could depoſit it; it might be ſufficient to enable them to conſtruct their combs, if they were at liberty to fly to the flowers, procure their pollen, and return to their hives after having filled their ſtomachs, where it muſt be elaborated, and converted into perfect wax. It was to obviate theſe doubts, that I undertook the following experiments.

"*Firſt Experiment.*—On bees in confinement, with honey alone for their nouriſhment. Muſt pollen be ate by bees, to be in a ſtate to produce wax? This was the firſt queſtion which I thought it neceſſary to inveſtigate: the method of trying the experiment was obvious;

it was only required to keep the bees within their hives, and thus prevent them from collecting or eating the fecundating powder. On the 24th of May, Burnons lodged a ſwarm in a ſtraw-hive, with as much honey and water as was neceſſary for their conſumption; and he cloſed the doors, ſo that the bees could not get out, and the air be at the ſame time renewed.

"At firſt the bees were very uneaſy, but became calm on removing the hive to a cool dark place; their captivity laſted five days; they were permitted to come out into a room, the windows of which were ſhut; we then examined the hive more conveniently. We firſt noticed that there was no honey left in the veſſel which had been filled with it, with the ſole intention of feeding the confined bees; and were more aſtoniſhed to ſee five combs of the moſt beautiful wax, ſuſpended from the roof of the hive; they were perfectly white, and very brittle. This reſult was very remarkable; however, before forming a concluſion from it, that the honey with which theſe bees were fed, had enabled them to produce the wax, it was neceſſary to inquire, whether it could not alſo be explained in another manner. The bees which I had employed had doubtleſs collected the duſt while they were at liberty. They might have done ſo the evening before, or on the very ſame day of their confinement, and might have enough in their ſtomachs, and in the cavities of their legs, to extract from it all the wax which we found in their hives. But if it was true that it had been obtained from the fecundating powder, previouſly obtained, this ſource was not inexhauſtible, and the bees being unable to procure any more, they would ſoon ceaſe to conſtruct combs, and fall into the moſt complete inaction. It was neceſſary, therefore, to repeat the ſame trial, to render it deciſive.

"The 28th, Burnons returned this ſwarm into its hive; after having taken out all the combs, he ſhut them up as before, with a freſh ſupply of honey. This experiment was not long, for on the evening of the ſecond day we perceived the priſoners working with new wax. The next day the hive was inſpected, and we found five combs, as heavy and as regular as thoſe made during the firſt captivity. We afterwards repeated this experiment five times ſucceſſively, with the ſame bees, and the ſame precautions: we always found that the honey had diſappeared, and that new wax was produced. This reſult was ſo invariable during this long ſecluſion, that we could no longer doubt that the honey alone had ſupplied them with all the elements of their wax, without the aſſiſtance of the fecundating duſt.

"*Second Experiment.*—On a hive from which honey was excluded, and in which only pollen and fruits, for the nouriſhment of the bees, were left, I thought it would not be uſeleſs to make the inverſe of the preceding experiment; it would ſhow me whether the pollen could not ſupply the want of honey, when the bees were deprived of it, and enable them to produce wax.

"I therefore encloſed a ſwarm in a bell-glaſs, in which had been placed a comb, whoſe cells contained only pollen, and the ſole nouriſhment of the bees was fruit.

"Theſe bees did not make combs, nor did they form a ſingle cell during eight days, which was the time of their captivity. I was going to repeat this experiment, when Burnons remarked, that the free bees were, in ſome meaſure, in the ſame ſtate as thoſe we had confined; there being no honey at that time in the flowers, they found only pollen, and did not work in wax.

"It may perhaps be aſked, how I was ſatisfied of this: to which I anſwer, bees wax is white at firſt, the cells ſoon become yellow; and in time, this colour grows browner; and in older hives have acquired a blackiſh tinge. It is, therefore, very eaſy to diſtinguiſh the new cells from thoſe which have been ſome time formed, and conſequently to know whether the bees are really making combs, or whether that work is ſuſpended; it is ſufficient to raiſe the hives, and to notice the lower edge of the combs.

"The odour exhaled by the hives, and the ſhape of the bees, are indications, by which it may always be known whether there is honey in the flowers: if they are combined, there can be no further doubt; and, particularly, if a great number of bees return to the hive, which are remarkable for the bulk and form of their bellies. Thoſe which are filled with honey, have the abdomen cylindrical; the name of wax-making bees, belongs to them excluſively: the bellies of the labouring bees, which have other functions, always preſerve their ovoid form, and their volume is never ſenſibly augmented; the name of *nurſing bees* is proper for theſe.

"The farmers of the neighbouring villages kept their bees in baſkets, or in caſes of different forms; and I was able to viſit a very great number, without going to any great diſtance from my habitation.

"In 1793, an intemperate ſpring had retarded the ſeparation of the ſwarms; there had not been any in the country before the 24th of May; but towards the middle of June there were ſeveral in the vicinity of my reſidence. At that time the fields were covered with flowers, the bees collected much honey, and the new ſwarms worked at the wax with vigour.

"On the 18th, Burnons viſited 65 hives; at the entrance of all of them he obſerved wax-making bees. Thoſe which returned to old hives, not having to conſtruct cells, depoſited their honey in the combs, or diſtributed it among their companions; thoſe belonging to the young ſwarms converted their honey into wax, and haſtened to conſtruct combs for the reception of their young bees.

"It was ſhowery on the 19th; the bees went abroad, but brought home only pollen. The weather was cold and rainy until the 27th. We were deſirous of knowing if this had prevented their working. On the 28th, all the hives were liſted. Burnons found that the work had been ſtopped; the combs which he had meaſured on the 19th, were not at all increaſed, and were of a citron yellow; nor was there a ſingle white cell in any of theſe hives.

"On the firſt of July, the cheſnuts and limes were in bloſſom; the thermometer indicated the twentieth degree; the wax-making bees reappeared; they carried away great quantities of honey, which, as we had before obſerved, was employed in augmenting the proviſions of the old hives, and enabling the young ſwarms to conſtruct new combs. The greateſt activity was obſervable among them; the gathering of honey, and the production of wax continued, until the middle of this month. July 16th, the heat remained the ſame; the field flowers, as well as thoſe of the cheſnut and limes, were completely withered; they yielded no more honey, their pollen alone attracted the working bees, and they collected

collected it abundantly; but there was not any wax produced; the combs were not lengthened; those of the young swarms did not fill more than two-thirds of their hives.

"August 9th. It had not rained for six weeks; the heat was very powerful, nor was there any dew to allay it during the night; the black wheat which had been in flower for some days, did not offer any honey to the bees; they found only pollen.

"On the 10th of August, it rained for several hours; next day, the black wheat had the odour of honey; in fact it might be seen glittering in their expanded flowers. The bees found enough to feed them, but too little to induce them to work at new wax.

"On the 14th, the drought recommenced, and lasted to the end of the month; no more honey appeared upon the flowers; and when we visited the 65 hives for the last time, we found, 1st, That the bees had not produced any wax after the middle of July. 2d. That they had stored up a great quantity of pollen. 3d, That the supply of honey was much lessened in the old hives, and that hardly any remained in the new swarms, that which they had collected in the spring having been employed in the preparation of wax. The pollen, therefore, has not this property, and no further doubt remained on this head. This year had not been stormy, and I have since ascertained, by a great number of observations, that electricity is singularly favourable to the secretion of honey by the flowers; the bees never collect it in greater abundance, nor is the preparation of wax ever more active, than when the wind is in the south, the air humid and warm, and a storm gathering.

"Heat too long continued, and the drought which is the consequence of it, cold rains, and principally a north wind, suspend it entirely.

"*Third Experiment.* On the use which the bees make of the fecundating powder. In the second experiment, the bees did not touch the pollen which I had placed within their reach, and as its quantity was not sensibly diminished during this trial, I was induced to believe it was not an aliment proper for them.

"I also knew that the new swarms were liable to perish from hunger in the middle of summer, and even when the country was covered with flowers, if a particular temperature, which is too uncommon in our climate, did not favour the secretion of honey in their nectaria. What, therefore, is the use of the pollen they collect with such avidity during eight months of the year, and of which they lay up such abundance (A)? This question remained to be investigated.

"I had a hive in divisions, the queen of which was barren; its combs did not contain any pollen, but they had much more honey; the two narrowest sides of this hive were formed of panes of glass, through which the surfaces of the exterior combs might be seen, and the conduct of the bees observed.

"I took away the queen on the 16th of July; but to console the working bees, I removed the first and twelfth combs, in which there was not any thing to interest them; and I supplied their places with two combs, the cells of which were filled with eggs and worms of all ages. I carefully cut away all the cells in which pollen could be perceived, and shut up the hive with a grating. My intention will be guessed; I wished to know whether these insects could support their young without this fecundating powder. The next day nothing extraordinary occurred; the bees sat on their eggs and seemed to nurse them.

"On the 18th, after sunset, a great noise was heard in the hive. Anxious to see what occasioned it, we opened the shutters, and observed that all was in confusion; the incubation was stopped; the bees ran over the combs in disorder; we saw thousands precipitate themselves on the stand, those which were nearest to the mouth eagerly gnawing the grating; their intention was no longer doubtful, they wished to get out of their confinement.

"I was fearful of destroying them by continuing to prevent them from yielding to their instinct; they were therefore set at liberty. The whole swarm came out, but the hour was unfavourable to their collecting: the bees did not go far from the hive, the darkness and the chilness of the air soon compelled them to return, and probably calmed their agitation; for we saw them quietly reascend their combs, and order appeared, to us, to be re-established. This moment was taken to close the hive again. On the 19th, we saw two royal cells begun on one of the combs of the nursery: the evening of this day, and at the same hour as the day before, we heard a great tumult in the closed hive; it was in a general confusion, and we were again obliged to permit the swarm to come out. The 20th was the fifth day of their captivity. We thought it had been of sufficient duration, and were also very impatient to examine the nursery, and to see what was the cause of this periodical agitation of these bees: Burnous therefore opened the first and twelfth windows, and drove the bees from the combs, suffering them to take their flight in a room, the windows of which were shut. He first noticed that the royal cells had not been continued, that they did not contain any worm, and that there was not an atom of the jelly which serves for the nourishment and the cradle of the larvæ of the queens. He sought in vain for eggs, for worms, and for the liquid in the common cells; all had disappeared. Had these worms died of hunger? Had we, by withdrawing the fecundating powder, deprived the bees of every means of nourishing the larvæ.

To ascertain this, it would be sufficient to restore them their pollen, and observe the issue. The bees were, therefore, again returned to their prison, after having substituted young worms for those which had been suffered to die.

"On the 22d, we found that the bees had fastened these combs, and that they were again in a state of incubation; we then gave them some pieces of combs in which other bees had stored up the fecundating powder; and

(A) Reaumur was of opinion that the bees of a well-stocked hive, might collect at least a hundred pounds of this substance in the course of a year; but having remarked that the weight of wax, fabricated in the same time, did not exceed two pounds, he concluded that the bees extract only a very small portion of the true wax from this native wax, that the greatest part of it is required for their nourishment, and that the rest is discharged from their bodies in the form of excrement.

and the better to obſerve what they did with it, we took ſome of the pollen out of the cells, and laid it expoſed on the ſtand of the hive. In a few minutes the bees diſcovered the pollen in the combs, and that which we had taken out; they took it grain by grain in their jaws, and conveyed it into their mouths; thoſe which had eaten moſt voraciouſly reaſcended the combs, and placed themſelves, at firſt, upon the cells of the young worms, which they entered head foremoſt, and remained there a greater or leſs length of time. One of the windows of the hive was now opened cautiouſly, Burnons powdered the bees which ate the pollen, and watched them for ſome hours; he obſerved that the marked bees always reaſcended the nurſery, and immediately entered the cells of the young bees.

"The 23d, we found the royal cells begun.

"The 24th, we drove the bees from off the young worms; and we remarked,

"1ſt. That all of them had the jelly, as in the common hives.

"2d. That the worms had grown larger, and were forwarder in their cells.

"3d. That others had been ſhut up again: and,

"4th. That the royal cells had been lengthened,

"The 25th, we withdrew the pieces of comb which we had placed on the ſtand, and found that the quantity of pollen was certainly diminiſhed; we afterwards replaced them in the hive with other cells filled with the fecundating powder.

"The 26th, the royal cells had been cloſed during the night, as well as ſeveral of the common ones.

"The 27th, I reſtored theſe bees to liberty. Burnons examined the cells with the greateſt attention, and found jelly in all thoſe which ſtill contained worms, but moſt of them were ſhut with a lid of wax: he examined ſome of the latter, and found the worms employed in ſpinning cocoons of ſilk.

"All the worms therefore had been tended as in the natural hive. In this ſecond trial we did not perceive any diſorder in this hive; there had not been the leaſt agitation: it is true ſome of the working bees attempted to go out in the courſe of the day; but finding it impoſſible, they reaſcended the combs quietly, which were never left for an inſtant. The hive being abundantly ſupplied with honey, and with the pollen neceſſary for their young, left them nothing to wiſh for; and they were ſtill more happy when a queen was born, who afterwards became pregnant, and laid a great number of eggs. After theſe two experiments, there could be no more doubt that the fecundating powder was the aliment proper for the young bees, and that the want of this ſubſtance was the cauſe of their death, and of the evident anguiſh of their nurſes during their firſt captivity.

"*Fourth Experiment.*—On bees deprived of honey and pollen, and which it was attempted to feed with ſugar. I wiſhed to know, if it was the ſaccharine part of the honey which enabled the bees to produce wax. Burnons confined a ſwarm in a glazed hive; one pound of Canary ſugar was their ſole aliment. He put a ſecond ſwarm into another hive, and endeavoured to feed them with very coarſe raw ſugar; and to obtain a term of compariſon, a third ſwarm was ſhut up in the ſame manner, and fed with honey. The bees of the three ſwarms produced wax; thoſe fed with the different qualities of ſugar produced it ſooner than the ſwarm which had only had honey, and they produced a greater quantity. A pound of Canary ſugar reduced to ſyrup, and clarified with white of egg, yielded 10 gros, 52 grains, of a wax not ſo white as that which the bees extract from honey. An equal weight of raw ſugar, gave 22 gros of very white wax. Maple ſugar produced the ſame effect. This experiment having been repeated ſeven times ſucceſſively, always employing the ſame bees, we could not doubt that ſugar contains the principles of wax; and concluded that it was the ſaccharine part of the honey which had this property.

"*Concluſion.* Theſe obſervations ſhew,

"1ſt. That the wax comes from the honey.

"2d. That the honey is alſo a food of the firſt neceſſity to the bees.

"3d. That flowers do not always contain honey, and that the ſecretion of honey depends in a great meaſure on the ſtate of the atmoſphere.

"4th. That it is the ſaccharine part of the honey which enables the bees to produce wax.

"5th. That raw ſugar yields more wax than honey, or refined ſugar.

"6th. That the duſt of the ſtamina does not contain the principles of wax.

"7th. That this duſt is not the food of the adult bees, and that they do not collect it for themſelves.

"8th. That the pollen affords the only aliment which is proper for their young; but that this ſubſtance muſt undergo a peculiar elaboration in the ſtomachs of the bees, to be converted into an aliment; which is always appropriated to their ſex, their age, and their wants; ſince the beſt microſcopes do not ſhew the particles of pollen, or their coverings in the liquor, prepared by the working bees."

Hairy, black; wings of a violet-colour. 38. A native of Europe, and of India. It pierces the trunks of decayed trees, or poſts, and forms longitudinal excavations, in which it conſtructs ſeveral neſts; having placed one at the bottom of the hole, it depoſits an egg in it, fills it with a mixture of honey and pollen of flowers, cloſes it up, and commences another; it proceeds in this way till the cells occupy the whole length of the perforation; the eggs are ſo placed in the cells, that the head of the larva points downwards towards the exit. *violacea.*

Humble-bee. Hairy, black; thorax marked with a yellow belt; anus white. 41. A native of Europe. It forms a neſt at a conſiderable depth under ground, and collects a good quantity of honey. *terreſtris.*

Hairy, black; the anus of a tawny colour. 44. A native of Europe; in heaps of ſtones, or in old walls. It collects a conſiderable quantity of honey. *lapidaria.*

Black; ſlightly covered with reddiſh hairs; abdomen ſmooth, marked with three bands, white above, and reddiſh beneath. 147. A native of Europe. It ſomewhat reſembles A. *mellifica*, but leſs. It comes out very early in the ſpring. *præcox.*

B. *The Tongue divided into three at the extremity.*

* *The Lip furniſhed on each ſide with two membranaceous briſtles.* Andrenæ.

Abdomen brown, marked with five whitiſh belts; the anus furniſhed with two ſmall projections. 136. A native of America. It forms its neſts in walls, of leaves *bidentata*

of trees neatly folded up; the fore legs are long and yellow; the feet fringed.

dichroa. Black; anus of a rufty colour. 137. A native of Europe; in groves.

** *Lip without briſtles, compreſſed, and entire; poſterior Feelers tongue-ſhaped.* Nomadæ.

fuecica. Covered with aſh-coloured hairs; the abdomen ſmooth and black; the ſecond and third ſegments of the abdomen of a rufty colour. 200. A native of Europe; in groves.

variegata. The thorax and abdomen variegated with white; the legs of a rufty colour. 24. A native of Europe. It ſleeps all night fixed to the flowers of the *geranium phæum*. The ſcutellum ſometimes of a rufty colour, and ſometimes white; the firſt and ſecond ſegments of the abdomen marked with two white ſpots; the third, fourth, fifth, and ſixth, marked with four.

morio. Very hairy, and black; the jaws broad, and marked on the outſide with elevated lines, and rounded at the points; wings of a reddiſh violet-colour. 214. A native of the ſouth of America. One of the largeſt of this genus.

92. FORMICA, *Ant*, or *Emmet*.

Feelers four, unequal, with cylindrical articulations, placed at the tip of the lip, which is cylindrical, and nearly membranaceous. Antennæ filiform. A ſmall erect ſcale placed between the thorax and abdomen. The females and neuters have a ſting concealed within the abdomen. The males and females have wings; the neuters none.

This is a gregarious, and proverbially induſtrious family, conſiſting, like bees, of males, females, and neuters. The laſt are the well known little inſects, who conſtruct the neſts or ant-hills, who labour with ſuch unremitting aſſiduity for the ſupport of themſelves and the idle males and females, and who guard with ſuch ferocity the larvæ, or what are commonly called ant eggs. They wander about all day in ſearch of food or materials for the neſt, and aſſiſt each other in bringing home what is too cumberſome for ſuch as have attempted it. They every day bring out of the neſt, and expoſe to the warmth of the ſun, the new hatched larvæ, and feed them till they are able to provide for themſelves. In the evening they conſume together whatever has been collected during the day, and do not, as is commonly ſuppoſed, lay up any ſtore for the winter, but probably become torpid or die. They are peculiarly fond of *aphides*, and are themſelves eagerly ſought after by the ant-eaters, and various birds. The puncture inflicted by their ſting, occaſions a hot painful itching ſenſation. They contain a peculiar acid. See CHEMISTRY *Index*.

**herculanea.* Black; the abdomen oval; legs of a rufty colour. 1. A native of Europe, and America; lodge in the trunks of decayed trees.

viatica. Of a rufty colour; the abdomen oval and black. 23. A native of Europe; runs very quickly; the tip of the jaws black; the abdomen ſmooth.

**ruſa.* Black; the thorax compreſſed; the legs of a rufty colour. 3. A native of Europe; it lodges in ſandy hills, in woods; it is large, and has no ſting.

**fuſca.* Black; the mouth, the tip of the thorax, and legs, of a rufty colour. 4. A native of Europe; in woods.

**rubra.* Of a brick colour; eyes black; a black dot under the abdomen. 7. A native of Europe. It lodges under ſtones in woods. They inflict a very painful puncture.

**cæſpitum.* Black; two knots on the filament which connects the abdomen to the trunk; the ſcutellum furniſhed with two ſmall projections. 11. A native of Europe; in dry meadows, under moſs. The males and females, in the month of Auguſt, leave their neſt about mid-day, when the weather is ſerene, and fly about in the air. The abdomen oval.

omnivora. The thorax marked with raiſed dots; the filament which joins the abdomen to the thorax is furniſhed with two knots; the body of a brick colour; the abdomen ſmall. 12. A native of America. It is very deſtructive to all ſorts of proviſions. Small. The abdomen brown, covered with white hairs ſcarcely perceptible.

aga. Black; abdomen oval and hairy. 52. A native of Europe; on decayed trees. It gnaws holes in the wood under the bark, and forms a number of paſſages for itſelf.

glabra. Black, ſmooth; the ſcale placed between the thorax and abdomen furniſhed with two ſmall projections; the diviſions between the ſegments of the abdomen whitiſh; legs reddiſh. 53. A native of Europe.

55 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

93. MUTELLA.

Mouth formed of a ſubſtance like horn; without a tongue. Jaw membranaceous at the tip. Lip projecting, reſembling an inverted cone; at the extremity of which are placed four unequal feelers, with conical articulations. Antennæ filiform. Wings wanting in moſt ſpecies. Body downy. The poſterior part of the thorax turned back. The ſting is pungent, and concealed within the abdomen.

occidentalis. Scarlet; the abdomen marked with a black belt. 1. A native of Europe. The antennæ, eyes, legs, and under part of the body black; the ſting long and filiform.

diadema. Black; the baſe of the abdomen marked with two yellow dots; the middle with an interrupted yellow ſtreak; the extremity with a ſmall white line. 10. A native of South America. Large; the lower part of the head marked with a white band; the thorax marked with two white lines, and with white on the inferior part.

aurata. Bluiſh; the abdomen marked with a large golden-coloured ſpot. 13. A native of New Holland.

**europæa.* Black; the thorax reddiſh; the edges of the ſegments of the abdomen white. 4. A native of Europe; in woods of maple.

halenſis. Hairy, black; the thorax reddiſh; the abdomen marked with two white dots, and with a white band on the poſterior part. 15. A native of Europe; the upper part of the ſhanks brown.

27 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature, publiſhed by Gmelin.

VI. DIPTERA.

Wings two. Poiſers clavated; one placed behind each wing, under a little ſcale.

94. Oestrus. *Gad-fly, Breeze.*

A ſucker drawn back within the lips, which are connected, and furniſhed with a ſmall pore. Feelers two, of two articulations, orbicular at the tip, and ſeated in a depreſſion on each ſide of the mouth. Antennæ ſhort and ſetaceous.

The face of this ſingular genus is broad and depreſſed, and has ſome reſemblance to the ape. They are extremely troubleſome to horſes, ſheep, and cattle, depoſiting their eggs in different parts of their bodies, and occaſioning painful tumours and even death. The larva is without feet, thick, ſhort, ſoft, and compoſed of ſeveral ſegments; they are ſometimes furniſhed with hooks. They lurk within the bodies, or under the ſkin, of horſes, oxen, &c.; and feed on their juices during the winter. The pupa is without feet, oval, and incapable of motion, covered with a hard light-brown cruſt. The perfect inſect lives but for a ſhort time.

* *bovis.* Wings brown, without ſpots; the abdomen black, white at the baſe, and of a tawny colour at the extremity. 1. A native of Europe. It depoſits its eggs on the backs of oxen, and lodges them under the ſkin. The larva, when young, is ſmooth, white, and tranſparent; as it advances in age it becomes browniſh, and when full grown and ready to be changed into a pupa, it acquires a dark-brown colour. It is lodged in a ſack formed in the cellular ſubſtance immediately under the ſkin, and occaſions a very conſiderable tumour on the back of the animal. The ſack communicates with the air by a very narrow opening, next to which the anus of the animal is placed. Through the anus a yellow purulent matter is diſcharged; and near the anus are ſituated two ſpiracula. There is a ſmall indentation on the oppoſite extremity of the larva, which is ſituated at the bottom of the ſack, ſurrounded by two or three papillæ, which forms the mouth. It has a number of dots on its ſurface, diſpoſed in tranſverſe interrupted lines. Two diſtinct and different kinds of lines are ſeen on each ſegment; the uppermoſt of them is narrower, and conſiſts of larger dots. Underneath this is a broader line, and the dots conſiderably ſmaller. The firſt are eaſily ſeen, by uſing the lens, to be hooks bent upwards, or towards the tail of the inſect. On examining the broader line of ſmall dots, with a tolerably powerful magnifier, they are alſo found to be hooks, but turned in an oppoſite direction, that is, downwards in the ſack, and towards the head of the inſect. Theſe hooks, it is probable, are occaſionally erected by the muſcles of the ſkin; and according to the ſeries of them uſed by the larva, it is raiſed or depreſſed in the ſack; and by this motion, and conſequent irritation, a more or leſs copious ſecretion of pus is occaſioned for its ſuſtenance.

This ſingular arrangement of hooks round the body of the larvæ, in this inſtance ſerves the ſame purpoſe as the legs in other larvæ, enabling them to move about in the ſack, and to crawl out of it when about to change into pupæ.

They never change their ſkin like moſt other larvæ, the ſame ſerving them through their growth; and it at length alſo ſerves to form the ſhell of the pupa. After leaving the ſack, and previous to their becoming pupæ, they contract themſelves, and aſſume a different figure.

They continue in the ſtate of pupæ from about the latter end of June until about the middle of Auguſt, when the fly appears. Full grown larvæ are ſometimes to be met with on the backs of cows in the month of September, which probably remain in the ſtate of pupæ till the enſuing ſpring. The perfect inſect, on leaving the hard cruſt which ſurrounds it, forces open a very remarkable, marginated, triangular valve, which may be traced in the ſkin of the larvæ, and is ſituated on one ſide of the ſmaller end.

The *oeſtrus bovis*, in its perfect ſtate, is the largeſt of the European ſpecies of this genus, and is very beautiful.

The pain it inflicts in depoſiting its eggs is much more ſevere than any of the other ſpecies. When one of the cattle is attacked by this fly, it is eaſily known by the extreme terror and agitation of the whole herd: the unfortunate object of attack runs bellowing from among them to ſome diſtant part of the field, or the neareſt water, while the tail, from the ſeverity of the pain, is held, with a tremulous motion, ſtraight from the body, in the direction of the ſpine; and the head and neck are alſo ſtretched out to the utmoſt. The reſt, from fear, generally follow to the water, or diſperſe to different parts of the field. When the oxen are yoked to the plough, the attack of this fly is attended with real danger, as they become perfectly uncontroulable, and will often run with the plough directly forwards, through the hedges, or whatever obſtructs their way. There is provided, on this account, a contrivance in many ploughs, to let them immediately at liberty.

The ſtrongeſt and healthieſt beaſts ſeem conſtantly to be preferred by it, and commonly have the greateſt number of botts, wormuls, or warbles, on their backs; dealers are frequently guided in their choice of cattle by this circumſtance. The female fly is very quick in performing the operation of depoſiting her eggs: ſhe does not appear to remain on the back of the animal more than a few ſeconds.

Gray, marked with a white band, and dotted with *buccatus* black. 6. A native of Carolina.

Black, hairy; wings of a ſooty colour; their outer *trompe.* edge bright black; head, thorax, ſcutellum, and anus, grayiſh yellow. 7. A native of Lapland. The larvæ occupy the frontal ſinus of the rein-deer; the animal ſometimes in the ſpring, forces out great cluſters of larvæ by ſneezing. This is the largeſt ſpecies of the genus.

Wings without ſpots; the thorax yellow, marked *tarandi.* with a black band; the abdomen tawny, and bright yellow at the extremity. 2. A native of Lapland. It depoſits its eggs on the back of the rein-deer. Such is their dread of it, that they every year leave the woods, and take refuge in the mountains. A very great proportion of them fall victims to this inſect, before they are three years old. Thoſe who eſcape with life are very much emaciated, and have their ſkins ſpoiled.

Botts.

* *equi.* *Botts.* Wings whitiſh, marked with a black band in the middle, and two black dots. A native of Europe. (*Vide* Tranſactions of the Linnæan Society, vol. iii. p. 326.) The forehead white and downy; top of the head brown; the eyes black, and diſtant from one another; thorax brown, with a dark-coloured centre; the abdomen yellowiſh brown, the diviſions between the ſegments of the abdomen marked with black ſpots and dots; the ſcutellum furniſhed with two tufts of hair; wings marked near the baſe with a very ſmall black dot, in the middle with a black band, and towards the extremity with two black ſpots. The male is diſtinguiſhed by a brighter yellow; the female by a deeper brown, and by the extremity of the abdomen which is long, bent inwards, and black, terminating in a bifid ſtyle. It depoſits its eggs on the hairs of the knees or ſides of horſes, which, when the animal licks itſelf, are conveyed by the tongue into the ſtomach. The body of the larva is compoſed of eleven ſegments, all of which, except the two laſt, are ſurrounded with a double row of horny briſtles directed towards the truncated end, and are of a reddiſh colour except the points, which are black. Theſe larvæ attach themſelves to every part of the ſtomach, but are generally moſt numerous about the *pylorus*; and are ſometimes, though much leſs frequently, found in the inteſtines. Their numbers in the ſtomach are very various, often not more than half a dozen; at other times more than a hundred; and if ſome accounts might be relied on, even a much greater number than this. They hang moſt commonly in cluſters, being fixed by the ſmall end to the inner membrane of the ſtomach, to which they adhere by means of two ſmall hooks or *tentacula*. When they are removed from the ſtomach they will attach themſelves to any looſe membrane, and even to the ſkin of the hand. For this purpoſe they ſheath or draw back the hooks almoſt entirely within the ſkin, till the two points come cloſe to each other; they then preſent them to the membrane; and keeping them parallel till it is pierced through, they expand them in a lateral direction, and afterwards, by bringing the points downwards towards themſelves, they include a ſufficient piece of the membrane, and remain firmly fixed for any length of time. Theſe hooks, the better to adapt them to this purpoſe, appear to have a joint near their baſe.

The larvæ attain their full growth about the latter end of May, when they quit their hold of the internal membrane of the ſtomach, and paſs along with the food through the inteſtinal canal. From the end of May till the beginning of July they may be ſeen in the dung which drops from the horſe; when they reach the ground they ſeek out ſome convenient ſituation, and become pupæ, and remain in that ſtate for about ſix or ſeven weeks. The mode purſued by the perfect inſect to obtain for its young a ſituation in the ſtomach of the horſe, is truly ſingular, and is effected in the following manner.—When the female has been impregnated, and the eggs are ſufficiently matured, ſhe ſeeks among the horſes a ſubject for her purpoſe; approaching it on the wing, ſhe holds her body nearly upright in the air, and her tail, which is lengthened for the purpoſe, curved inwards and upwards: in this way ſhe approaches the part where ſhe deſigns to depoſit the egg; and ſuſpending herſelf for a few ſeconds before it, ſuddenly darts upon it, and leaves the egg adhering to the hair; ſhe hardly appears to ſettle, but merely touches the hair with the egg held out on the projected point of the abdomen. The egg is made to adhere by means of a glutinous liquor ſecreted with it. She then leaves the horſe at a ſmall diſtance, and prepares a ſecond egg, and poſting herſelf before the part, depoſits it in the ſame way. The liquor dries, and the egg becomes firmly glued to the hair: this is repeated by various flies till 400 or 500 eggs are placed ſometimes on one horſe.

The inſide of the knee, or thoſe parts of the body of the animal that are liable to be licked, are choſen by the fly from inſtinct, as the proper places for depoſiting its eggs. The well-known diſeaſe in horſes called the *botts*, which frequently proves fatal, is ſuppoſed to be occaſioned by the larvæ of this inſect.

Wings without ſpots; the thorax of a ruſty colour; *naſalis.*
abdomen black, covered with yellow hairs. 3. A native of Europe. This inſect is ſaid to depoſit its eggs in the noſtrils of horſes, mules, aſſes, and of goats; and the larvæ occupy the fauces. Body black; thorax deſtitute of furrows; the head and abdomen covered with yellow hairs, except the firſt ſegment, which is covered with white ones.

Thorax yellow, marked with a black band; wings * *hæmorrhoidalis.*
white, marked with black bands. 4. A native of Europe. It depoſits its eggs on the lips of horſes, occaſioning a titillation, which cauſes the animal, when attacked by it, to move his head about violently, and gallop about with every appearance of diſtreſs. The larva of this inſect needs not to be particularly deſcribed, as it reſembles in almoſt every reſpect that of the *equi*. Its habits are the ſame, being ſeen in the ſtomach of the horſes, occupying the ſame ſituation as thoſe of the *equi*, from which they can only be diſtinguiſhed by their ſmaller ſize and greater whiteneſs. When it approaches maturity it acquires a red colour. It is frequently ſeen adhering to the extremity of the rectum; which circumſtance, along with its colour, has occaſioned it to receive the name of *hæmorrhoidalis*. In about two days after it has left the body of the horſe, it is changed into a pupa, in which ſtate it remains nearly two months.

Wings faintly dotted; the abdomen variegated with * *ovis.*
white and black. 5. A native of Europe. The larva occupies the frontal ſinus of the ſheep; they are flat on the one ſide, and convex on the other; of a whitiſh colour; and nearly of the ſame ſize with the larvæ of the *O. equi*. When young theſe larvæ are perfectly white and tranſparent, except the two horny plates, which are black. As they increaſe in ſize, the upper ſide becomes marked with two tranſverſe brown lines on each ſegment, and ſome ſpots are ſeen on the ſides. When full grown they fall through the noſtrils, and change to the pupa ſtate, lying on the earth. The inſect depoſits its eggs on the inner margin of the noſtrils of the ſheep. The moment the fly touches that part of the ſheep, they ſhake their heads, and ſtrike the ground violently with their fore feet; at the ſame time holding their noſes cloſe to the earth, they run away, looking about them, on every ſide, to ſee if the fly purſue. They do not, like the horſes and cows, take refuge in the water; they have recourſe to a rut, or duſty road, or a gravel pit, where they crowd together during the

heat of the day, with their noſes held cloſe to the ground, which renders it difficult for the fly conveniently to get at the noſtril.

antilopæ. Wings dotted with brown, and marked with a brown band; body hairy, of a grayiſh yellow colour; the abdomen marked with three rows of blackiſh ſpots. 8. A native of Aſia. It depoſits its eggs under the ſkin of the back of the antelope. About the ſize of the *muſca carnaria*.

faſciculoſus. Yellow and downy; the anus furniſhed with three tufts of black hairs. 9. A native of Siberia; head and eyes black.

hominis. Entirely brown. 10. A native of South America. Depoſits its eggs under the ſkin of the abdomen of the natives, or of people reſiding in countries where they are prevalent. The larvæ continue ſix months under the ſkin; if they be diſturbed, they penetrate deeper, and produce very troubleſome ulcers, which ſometimes prove fatal.

10 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

95. Tipula, *Crane-fly.*

Mouth furniſhed with a very ſhort proboſcis, membranaceous, and grooved on the back, receiving a briſtle; with a ſhort ſucker without a ſheath; and with feelers two, equal, filiform, and longer than the head. Antennæ in moſt of the ſpecies filiform.

Moſt of this genus have a great reſemblance to the gnat. They feed on various ſubſtances. The larva is ſoft, without feet, and cylindrical; its head is furniſhed with a ſmall projection, and terminates abruptly; they feed on the roots of plants; they are eagerly ſought after by crows and other birds. The pupa is cylindrical, and is furniſhed with two horns on the anterior extremity, with ſmall projections behind.

A. *Wings expanded.*

* *pectinicornis.* The antennæ pectinated; the wings marked with a black ſpot; the thorax yelloviſh. 1. A native of Europe; in moiſt places. The abdomen reddiſh at the baſe, marked with a yellow band in the middle, black at the tip.

* *oleracea.* Wings tranſparent, with a brown rib along the edge. 5. A native of Europe. It does a great deal of miſchief in gardens, corn fields, and meadows, by conſuming the roots of potherbs, growing corn, and graſs.

* *hortorum* Wings tranſparent, ſprinkled with very faint ſpots. 6. A native of Europe; in gardens, deſtroying the crops.

* *triangularis.* One half of the wings brown, marked with white triangular ſpots. 111. A native of Scotland.

* *variegata.* Black; the baſe and ſides of the abdomen red, ſpotted with yellow. 7. A native of Europe; in gardens.

* *pratenſis.* The thorax variegated; abdomen brown, ſpotted with yellow on the ſides; the forehead tawny. 10. A native of Europe; in meadows. It is very deſtructive to the roots of graſs.

cornicina. Wings tranſparent, marked on the edge with a brown ſpot; the abdomen yellow, marked with three brown lines. 12 A native of Europe. Very deſtructive to the roots of plants, and much ſought after by crows.

Wings tranſparent, and ſhining; body of a browniſh aſh colour. 21. A native of Europe. This ſpecies appears very early in the ſpring; and may be ſeen dancing in the air in great numbers in mild weather.

* *regelationis.*

B. *Wings incumbent.* Culiciformes.

Thorax greeniſh; wings white, marked with a brown dot; the antennæ feathered. 26. A native of Europe; in marſhy places.

* *plumoſa.*

Greeniſh; wings ſpotted; the fore legs very long. 27. A native of Europe; on the ſea coaſt.

* *littoraliſ.*

Black, ſmooth; wings white, marked with a black dot; the antennæ ſhort; legs black. 41. A native of Europe; in ſhaded places.

johannis.

Black; ſmooth, wings tranſparent, marked with a black dot; the thighs of a ruſty colour. 101. A native of Britain, and Norway; on the flowers of fruit trees.

* *pomonæ.*

Black, ſilky. 45. A native of Europe; on the flowers of fruit trees, which it injures very much. It frequently blaſts the hopes of the farmer.

ſterilega.

Wings tranſparent; the outer edge black. 46. A native of Europe. It is very deſtructive to aſparagus, and to the flowers of fruit trees. The thorax and abdomen ſometimes black, ſometimes red.

* *hortulana.*

Wings of an aſh colour; the thorax and abdomen yellow. 123. A native of Chili. This inſect has a very pleaſant ſmell, and is made uſe of by the young girls of Chili for perfuming their clothes.

moſchifera.

Of a tawny colour, wings white and tranſparent, hairy on the margins; the eyes black. A native of England. Larva leaps; without feet; is orange-coloured, and marginated; the margin folded with papillæ; the head acute; the tail terminating abruptly. The pupa is narrow, acute at both ends and reddiſh.

* *tritici.*

126 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

96. Diopsis.

The head furniſhed with two filiform horns, without articulations, much longer than the head, on the tops of which the eyes are placed.

1. A native of North America and Guinea. Reddiſh; antennæ very ſmall and ſetaceous; the horns of a ruſty colour; the eyes which terminate the horns are globular and black; the thorax black; furniſhed with two yellow tapering projections behind, and with a ſingle one on each ſide; wings tranſparent, and marked with a black dot before; the abdomen clavated, and attached to the trunk by a narrow ſtalk; the two laſt ſegments of the abdomen black; the legs yellow; the thighs of the legs clavated. It reſembles an *ichneumon*, and is about the ſize of the red ant.

ichneumonea.

Only one ſpecies of this genus has been deſcribed in the laſt edition of the Syſtem of Nature.

97. Musca, *Fly.*

Mouth furniſhed with a fleſhy projecting proboſcis, with two equal lips, with a ſucker furniſhed with briſtles, and with two ſhort feelers. Antennæ ſhort (in moſt ſpecies).

Flies live chiefly in dunghills; their larvæ are without feet,

feet, compoſed of ſeveral ſegments, nearly cylindrical, and becoming ſmaller behind. The larvæ of the flies of the firſt and ſecond diviſions, live in the water, have a breathing hole at their head, are bearded, and live on aquatic animalculæ; thoſe of the fourth diviſion live on rubbiſh; thoſe of the third on dung, putrid animal ſubſtances, and on ſmall inſects; ſome of them particularly on *aphides:* they remain fixed on a leaf, and with their ſnout collect, and devour the *aphides.* The pupæ are immoveable, and moſt of them covered with a hard ſkin; the pupæ of the flies of the firſt and ſecond diviſions are cylindrical, and covered with the ſkin of the larvæ, which becomes hard.

A. *The Sucker compoſed of a ſingle valve; the Antennæ connected at the baſe, and ſharp at the points.*
Bibiones.

* *plebeja.* Of an aſh colour, and hairy; the abdomen conical; the edges of the ſegments white. 1. A native of the north of Europe. The thorax is ſometimes yellow, and abdomen of a ruſty colour.

* *marginata.* Black; the abdomen conical; the edges of the ſegments white; the wings ſpotted. 130. A native of Europe.

B. *Sucker without a ſheath.*

a. *Thoſe which have a ſingle briſtle.*

† *The Antennæ pointed and connected at the baſe.*
Stratiomyes.

* *chamæleon.* The ſcutellum pale yellow, and furniſhed with two ſmall projections; the abdomen black, marked on the ſides with yellow bands. 3. A native of Europe; on flowers. The larva lives in freſh water.

uliginoſa. Body black; the ſcutellum without projections; the abdomen white, and black at the extremity. 22. A native of Europe. The forehead yellow; the joints of the legs white; the ſhanks of the legs pale.

* *vallata.* The ſcutellum marked with ſix projections; the abdomen and thighs yellow. 166. A native of Britain; on hedges. Wings of a faint ruſty colour; incumbent and plain; the nerves of the wings marked with a brown dot in the middle; the poiſers yellow; the feet, and lower extremity of the ſhanks of the legs brown.

nectarea. Black; antennæ cylindrical and perfoliated; wings white. 24. A native of Europe; on the flowers of apple trees. It drinks the nectarious juice, and lodges all day long within the flower; it is very ſmall, and not larger than a common flea; body oblong; legs long.

†† *The Antennæ ſhort and clavated, furniſhed with a briſtle.*

* *Feathery, or with hairy feathered Antennæ.*

* *inanis.* Brown; the abdomen tranſparent, marked with three black belts, 61. A native of Europe; in thickets.

* *pellucens* Black; the firſt ſegment of the abdomen white, and tranſparent. 62. A native of Europe; in ſhaded places.

* *cæſar.* Shining green; legs black. 64. A native of Europe; on carrion.

cornicina. Thorax of a ſhining copper colour; the abdomen of a greeniſh yellow with a metallic luſtre; legs black. 169. A native of Europe. The ſides of the lips of a ſhining ſilver colour.

Shining; the thorax blue; the abdomen green. 65. * *cadaverina.*
A native of Europe; on carrion.

The thorax black; the abdomen ſhining blue; the * *vomitoria.*
forehead tawny. 67. A native of Europe and America; on carrion; they conſume dead bodies very quickly; they likewiſe feed on milk.

Black; the thorax marked with pale lines; the ab- * *carnaria.*
domen ſhining, and chequered. 68. A native of Europe; on carrion. The eyes reddiſh; the anus tawny. The larva likewiſe infeſts bee-hives.

Common houſe-fly. The thorax marked with lines; * *domeſtica*
the abdomen chequered, and pale on the under ſide at the baſe. 69. A native of Europe and America; in houſes. The larvæ live in horſe dung.

Brown; the thorax blue and downy, marked with *olea.*
three eminences; the tip of the ſcutellum and thighs yellow. 390. A native of Europe; very deſtructive to olives. The female depoſits a great number of eggs in the month of July, on the fruit of the olive; the larvæ conſume the pulp.

* * *The Antennæ furniſhed with a naked briſtle.*

Smooth, black; the abdomen wrinkled on the upper *feneſtrata*
ſide, marked with white ſtreaks; wings brown. 14. A native of Europe: in windows.

Blackiſh; the tip of the ſcutellum of a faint brick * *larva-*
colour; the abdomen chequered. 78. A native of *rum.*
Europe; on the caterpillars of moths and butterflies, and likewiſe on the roots of cabbage and colewort, rendering the root knotty; the tips and baſe whitiſh; thorax black, marked with lines.

Black; the abdomen of an aſh colour, marked with * *radicum.*
black bands. 79. A native of Europe; on the roots of the raddiſh.

Hairy and whitiſh, marked with a black line on the *napobraſ-*
back, and with ſeveral black lines along the ſides. 208. *ficæ.*
A native of Europe; on the roots of the turnip, which it deſtroys, and cauſes to appear as if rotten; it attacks thoſe turnips chiefly that have been ſown in light ſandy ſoil. The larva is white, without feet; the head is pointed and tipt with black; it undergoes its transformation about September. Pupa is oblong, brown, compoſed of ſeveral ſegments, and becomes a perfect inſect in May.

Of an aſh colour; the thorax marked with five black *pluvalis.*
ſpots; the abdomen marked with very faint ſpots. 83. A native of Europe. It is to be ſeen flying about in ſwarms before rain.

Hairy and aſh-coloured; the extremity of the thighs * *rapax.*
and ſhanks of the legs of a ruſty colour. 212. A native of Britain; and feeds on other flies.

Black; the abdomen pale; the eyes of a ruſty co- * *cellaris.*
lour. 87. A native of Europe; in cellars.

Black; the abdomen of an aſh colour; the wings * *meteorica*
yellowiſh at the baſe. 88. A native of Europe. They fly about very much in the air immediately before rain, and collect about the mouths of horſes in great ſwarms, particularly about the ſummer ſolſtice. The larvæ are ſometimes found in the human ſtomach.

Shining black; eyes browniſh; wings ſhining red and *avenæ.*
green. 216. A native of Europe; in oats, which it

destroys by gnawing the stalks when young. Larva yellowish and without feet

* *frit.* Black; the poisers and feet of the hind legs, and abdomen, pale green. 90. A native of Europe; on the ears of barley. It is so frequent in Sweden, that it has been calculated that one tenth of the grain is consumed by it annually.

* *pumilionis.* Black; the under part of the head, and two lines on the thorax yellow; the poisers white; the legs of an ash colour and black at the tip. 217. A native of Europe. The larva has a sharp head, black at the extremity; the body white, composed of ten segments; it is changed into a pupa about the end of May. The pupa is yellow, shining, and composed of several segments; the perfect insect appears about the middle of June. At what time it deposits its eggs is not well ascertained. The larvæ are perceived early in the spring, in the centre of the stalks of wheat and rye, very near the root. In all probability the eggs have been deposited in the month of October, or end of September, as the early sown grain is found to be most affected. White wheat is more liable to be injured than red. The stalks in which the larva is lodged, do not advance in growth, but continue dwarf, whence the insect has received the name of *pumilionis*. The stalks become yellow in the beginning of summer, and decay; others commonly spring up from the same root, and supply their place. This insect first attracted notice in England in the spring of the year 1791, when it excited some alarm, as fears were at first entertained that it was the Hessian fly, which had done so much mischief in America. Some plants of infected wheat were sent to Mr Markwick by a friend in the neighbourhood of Battle. Mr Markwick succeeded in obtaining the perfect insect from them, of which he has given an account, (*Vide* Transactions of the Linnean Society, p. 76. tab. 15.) Some of the infected wheat was likewise sent by Arthur Young to Sir Joseph Banks, who ascertained the insect to be the *musca pumilionis* described in Gmelin's System of Nature, and not the Hessian fly. An account of this fly, and of the mischief caused by it, was first published in the Transactions of the Royal Academy of Sciences at Stockholm for the year 1778, by Mr Ob. Bjerkander, who discovered it on the young shoots of the rye, in the month of May; and in such quantity, that in some fields he found three or four stalks affected in a square foot.

petronella. Livid; the forehead red; the legs long, and of a light red colour; the joints of the legs black. 96. A native of Europe. It may be seen running about on the surface of stagnant water.

fonchi. Wings transparent, marked on the edge with a black spot; the eyes green. 121. A native of Europe; on the receptacles of the flower of the sow-thistle. Thorax brown, with a pale scutellum; the abdomen black, oval, and greenish beneath; the edges of the segments whitish; tail with an obtuse style; wings with two brown nerves; legs of a brick colour.

b. *Sucker furnished with three bristles.* Ragiones.

vermilio. Of an ash colour; the abdomen marked with three rows of black dots; the thorax spotted; the wings without spots. 17. A native of Europe; in loose sand.

colombatschensis. Black; the divisions between the segments of the abdomen, the shanks of the legs, and feet, white. 324. A native of Europe and Asia. It is about half the size of the common gnat, and is most frequent in the beginning of spring and end of summer, in Servia, Russia, and Siberia; where it insinuates itself into the bodies of cattle, which it frequently destroys, as its bite proves fatal in a few hours; smoke is very offensive to it; and in the places where it prevails the people have recourse to it, as their only mode of defence.

papataſi. Antennæ, body, and wings hairy. 325. A native of Europe. It is very troublesome in Lombardy in the night time, during the whole summer. It is very minute; eyes black, dotted with white; the wings when the insect is at rest, diverge so as to form an obtuse angle; the abdomen red.

acuminata. Black; the abdomen long, slender, and tapering towards the extremity; the wings spotted; the thighs reddish-yellow; the shanks of the legs and feet brownish. 226. A native of Europe.

c. *The Sucker furnished with four bristles.* Syrphi.

‖ *Bristle of the Antennæ feathery.*

* *bombylans.* Black; the abdomen hairy, and reddish behind. 25. A native of Europe; among bushes.

* *apiaria.* The anterior part of the thorax yellow; the extremity of the abdomen white; the wings of a rusty colour at the tip. 328. A native of Europe; the posterior part of the thorax, the forehead, and abdomen black; wings obscure.

‖ ‖ *The Bristle of the Antennæ simple and smooth.*

conopsea. Black, without hairs, the sides of the thorax marked with yellow lines, the abdomen with three yellow lines. 21. A native of Europe; among bushes.

* *pendula.* The thorax marked with four yellow lines; the abdomen with three interrupted yellow bands. 28. A native of Europe. The larva lives in stagnant water, and is suspended by a long filiform tube through which it breathes.

* *tenax.* Thorax gray; the abdomen brown; the thighs of the hind legs compressed. 32. A native of Europe; in dunghills, in necessaries, and in putrid water. The larva is very tenacious, and difficultly destroyed by pressure.

* *pyrastri.* Very slightly hairy, black; the thorax without spots; the abdomen marked with six white circular spots. 51. A native of Europe; and feeds on the *aphides* on the leaves of the pear tree.

* *merthastri.* Black; not hairy; the thorax spotted; the abdomen marked with four yellow belts, the scutellum yellow, 54. A native of Europe; on flowers, chiefly on the mint. The perfect insect feeds on honey, the larva on aphides.

saltatrix. Naked; yellow; the upper part of the abdomen brown; the thorax marked with three brown lines. 60. A native of Europe; in meadows, where it leaps about on the ground like a grasshopper; the longitudinal line on the thorax, somewhat broad, marked with an oblong black spot, and with a black line on each side towards its extremity; poisers white.

360 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature, publiſhed by Gmelin.

98. Tabanus, *Ox-Fly*.

Mouth furniſhed with a ſtraight, projecting, and membranaceous proboſcis; with a ſmall and oval head; with two equal lips; with a long projecting ſucker, which can be concealed in a groove on the back of the proboſcis. Sheath of one valve, and furniſhed with five briſtles. Feelers two, equal, clavated, and ſharp at the points. Antennæ ſhort, cylindrical, approaching to one another, pointed, and compoſed of ſeven articulations.

Theſe inſects live by ſucking out the blood of various animals, of which they are very greedy. The larvæ are found under ground, in moiſt meadows: the colour of the eyes vaniſhes when the inſect is dead, but may be reſtored by placing it in warm water.

* *bovinus.* Eyes greeniſh; the back of the abdomen marked with long triangular white ſpots. 4. A native of Europe. It is very troubleſome to horſes, and horned cattle; their bite is painful; they even moleſt the human ſpecies in very warm weather; they are moſt frequent in moiſt ſituations.

tarandinus Eyes green; the ſegments of the abdomen yellow on the edges; legs reddiſh. 7. A native of Europe. They wound the tender horns of the rein-deer, and ſpoil their ſhape; they are met with in Italy, and the ſouthern parts of Europe, as well as in Lapland.

pellucens. Black; eyes marked with bands; firſt ſegment of the abdomen bluiſh; the ſhanks of the legs pale.

* *paganus.* The anterior parts of the eyes green, marked with three tawny bands; the abdomen marked on both ſides with ruſty-coloured ſpots. 25. A native of Britain.

* *tropicus.* Eyes marked with three purple bands; the ſides of the abdomen of a ruſty colour. 14. A native of Europe; very troubleſome to cattle, eſpecially to horſes, immediately before rain.

* *pluvialis* Eyes green, marked with four waved bands; wings dotted with brown. 16. A native of Europe.—This little animal fixes on the hands, face, and legs, and excites a painful inflammation in the part where it has drawn blood.

* *cæcutiens.* Eyes green, dotted with black; wings without ſpots. 17. A native of Europe. It is extremely troubleſome in hot weather, eſpecially before rain, fixing on the hands and face, or any uncovered part; it draws blood very dexterouſly, and leaves an inflamed bloody puncture behind.

38 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature publiſhed by Gmelin.

99. Culex, *Gnat*.

Mouth furniſhed with a ſheath of one piece, flexible, and ſet with five briſtles. Feelers two, compoſed of three articulations. Antennæ filiform.

The inſects of this genus live on the juices of the larger animals, and are eagerly ſought after by poultry, and ſmall birds. The larva lives in ſtagnant waters, and has a ſmall cylindrical reſpiratory tube, near the tail; the head is armed with hooks to ſeize on the aquatic inſects upon which it feeds; it is devoured by ducks, and water fowl. The pupa is curved and oval, with reſpiratory tubes near the head. They continue but a ſhort time in the ſtate of larva and pupa. The perfect inſect depoſits her eggs in cluſters on the ſurface of the water, where they remain for a few days until they are hatched. Gnats in this country, however troubleſome they may be, do not make us feel them ſo ſeverely, as the muſquito does in foreign parts.

* *pipiens.* Of an aſh colour; the abdomen marked with eight brown rings. 1. A native of Europe, and the northern parts of Aſia and America; in the neighbourhood of freſh waters, and in marſhy places. It is larger in more ſoutherly climates, and its bite occaſions more pain and inflammation. When on the wing it makes a conſtant ſhrill noiſe, whence it has received its name *pipiens*. The male is not eaſily diſtinguiſhed from the female by its pectinate antennæ: it is more troubleſome, and its bite more painful than that of the female. Ducks, and other aquatic fowls, feed their young with them; different ſpecies of the *libellula* likewiſe devour them. They ſometimes inſinuate themſelves into the lungs and inteſtines of quadrupeds, where their bite excites a fatal inflammation. The natives of countries where they are very troubleſome, have recourſe to the ſmoke of different vegetables as a defence. In warm climates they are frequently compelled to make uſe of gauze curtains, which they draw cloſe round them when aſleep. They are ſaid to ſhine in the dark.

annulatus. Brown; the abdomen and feet marked with white rings; the wings ſpotted. 8. A native of the north of Europe; the ſnout half the length of the body.

* *bifurcatus.* Brown; the thorax faintly marked with lines. 3. A native of Europe; in marſhy ſituations.

* *pulicaris* Brown; wings white, marked with three obſcure ſpots. 10. A native of Europe; it creeps about a great deal; its bite is ſucceeded by a brown ſpot.

13 ſpecies of this genus have been deſcribed by Gmelin, in the laſt edition of the Syſtem of Nature.

100. Empis.

Sucker with a ſheath of one piece, furniſhed with three briſtles, and an inflected proboſcis. Feelers ſhort, and filiform. Antennæ ſetaceous.

The minute inſects which compoſe this genus, live by ſucking out the blood and juices of other animals.

* *borealis.* Black; wings nearly round, and of a ruſty colour. 1. A native of Europe; they may be ſeen dancing in the air in great numbers in the evening when the weather is good.

* *pennipes.* Black; the hinds legs long and feathered. 2. A native of Europe; it is frequently found on the leaves of the *geranium ſylvaticum*, and *cardamine pratenſis*.

* *livida.* Livid; thorax marked with lines, the baſe of the wings and legs of a ruſty colour. 3. A native of Europe; it is frequently to be found on the *heraclium ſpondylium*; the upper part of the abdomen very dark brown; wings oblong, marked with brown veins.

Of

* *cinerea.* Of an aſh colour; thorax without ſpots; legs pale; wings brown at the tip. 9. A native of Europe; on umbelliferous plants.

19 ſpecies of this genus are deſcribed in the edition of the Syſtem of Nature publiſhed by Gmelin.

101. Stomoxys.

Sucker conſiſting of a ſheath of one piece, and furniſhed with enclofing briſtles. Feelers two, ſhort, briſtle-ſhaped, and compoſed of three articulations. Antennæ ſetaceous.

The inſects of this genus live by ſucking the blood and juices of other animals; thoſe of the diviſion *ringiæ* principally attack inſects of the orders *lepidoptera* and *diptera*.

A. *The Sheath convoluted, and bent at the baſe, with an angular flexure, and furniſhed with two briſtles.*

* *calcitrans.* Gray; antennæ ſlightly feathered; legs black. 4. A native of Europe. It reſembles the common fly very much in every reſpect, except in the ſnout, and in having the ſegments of the abdomen marked with two black ſpots. It is very troubleſome to horned cattle; by getting about their feet, it cauſes them to kick, and ſtamp with their feet: before rain it bites more frequently. It does not ſpare the human ſpecies, particularly in autumn.

* *irritans.* Of an aſh colour, and ſomewhat hairy; the abdomen ſpotted with black. 5. A native of Europe. This ſpecies is very frequent, and troubleſome to cattle; by fixing on their backs, it cauſes them to keep their tails almoſt in conſtant motion to laſh it off.

pungens. Of an aſh colour, wtth black thighs. 6. A native of Europe. It is very troubleſome to cattle, reſembles *St. irritans*, but much ſmaller wings; whitiſh, without ſpots; the abdomen ſometimes of a dark colour.

B. *Sheath covering the mouth, and furniſhed with four briſtles.* Rhingiæ.

* *roſtrata.* Thorax faintly marked with lines; the ſnout, legs, and abdomen of a brick colour. 8. A native of Europe. Very troubleſome to cattle; about the ſize of the common fly; wings pale.

lineata. Thorax marked with lines; abdomen black, marked on the ſides with yellow ſpots. 9. A native of Europe. The lip long, yellow, with a black emarginated tip, and formed of a horny ſubſtance enclofing the proboſcis. The antennæ black, with a ruſty-coloured knob, and furniſhed with a briſtle; the thorax marked with four white lines; the ſcutellum of a brick colour; wings whitiſh; legs yellow; the thighs marked with a white belt.

Only 9 ſpecies of this genus have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature.

102. Conops.

Mouth furniſhed with a projecting ſnout, which is bent with an angular flexure. Antennæ clavated, and pointed at the extremity.

The inſects of this genus live by ſucking the blood and juices of other animals.

A. *Sucker furniſhed with a ſhort valve of one piece, and with a ſingle briſtle.*

* *veſicularis.* Blackiſh; back part of the head veſicular, the abdomen yellowiſh and black at the baſe. 4. A native of Europe; in groves.

* *macrocephalus.* Black; ſix ſegments of the abdomen yellow on the edges; antennæ and legs reddiſh. 5. A native of Europe; in groves.

B. *The Sucker bent both at the middle and at the baſe, with an angular flexure. Sheath conſiſting of two pieces, the two pieces which compoſe the Sheath equal.* Myopæ.

* *ferrugi-nea.* Of a ruſty colour; the abdomen cylindrical, and bent inwards; the forehead reddiſh. 8. A native of Europe; in groves.

atra. Abdomen cylindrical, and bent inwards; body black. 2. A native of Europe; among buſhes.

14 ſpecies of this genus are deſcribed in the edition of the Syſtem of Nature publiſhed by Gmelin.

103. Asilus.

Mouth furniſhed with a ſucker, compoſed of a horny ſubſtance, projecting, ſtraight; conſiſting of two pieces, and turgid at the baſe. Antennæ filiform.

They prey on other inſects, eſpecially thoſe of the *lepidopterous* and *dipterous* orders.

* *crabro formis.* The abdomen hairy; on the fore part there are three of the ſegments black; behind yellow and bent inwards. 4. A native of Europe. The larva lives under ground. This is the largeſt ſpecies of the genus which is to be met with in Britain. Its ſting is very painful.

epiphium. Hairy, black; the thorax white at the baſe. 19. A native of Europe.

* *ater.* Hairy, black; with a whitiſh band. 7. A native of Europe. It reſts by leaning on its breaſt, with its legs ſpread. Claws white.

diadema Black; wings black; the forehead white. 22. A native of Europe. Band and wings wholly black.

* *tipuloides.* Of an aſh colour, without hairs; legs of a ruſty colour; feet black. 14. A native of Europe.

ſtriatus. Black; the thorax marked on each ſide with an aſh-coloured line; the poiſers yellow. 44. A native of Europe.

Gmelin has deſcribed 48 ſpecies of this genus, in his laſt edition of the Syſtem of Nature.

104. Bombylius, *Buz-fly.*

Mouth furniſhed with a ſucker, very long, ſetaceous, ſtraight, and compoſed of two valves, the valves unequal, and likewiſe with three briſtles. Feelers two, ſhort, and hairy. Antennæ tapering towards the point, and connected at the baſe.

The ſpecies of this genus feed on the nectarious juice of flowers which they collect when on wing.

Humble

* *major.* *Humble Bee.* Wings with a broad black waved outer edge; body black, with thick yellowish down. 1. A native of Europe.

* *medius.* Wings dotted with brown; body yellowish and white behind. 2. A native of Europe. It is to be met with very early in the spring.

minimus. Wings brownish at the base; body yellowish, and hairy; snout and legs black. 7. A native of Europe. Very small; antennæ black; wings white.

griseus. Hairy; wings white, brown at the base; thorax black, marked with white lines; abdomen gray. 11. A native of Europe; on compound flowers. Wings marked with two black dots in the middle.

virescens. Wings white, without spots; body hairy, and greenish; the snout short. 12. A native of Europe; on flowers. Thickly covered with greenish hairs.

There are 15 species of this genus described in the last edition of the System of Nature.

105. Hippobosca.

Mouth furnished with a short, cylindrical, straight sucker, composed of two equal pieces. Antennæ filiform. Legs furnished with many claws.

The species of this genus live on the blood of other insects.

* *equina.* *Horse-fly.* Wings obtuse; thorax variegated with white; legs terminating in four claws. 1. A native of Europe and America.—They are very troublesome to horses; they hide themselves under the hairs, and attach themselves firmly to the skin, by means of their crooked claws.

* *avicularia.* Wings obtuse; thorax of one colour. 2. A native of Europe; on the bodies of various birds, especially swallows. Wings longer than the body by one half, marked with black veins; the hind part of the abdomen flattened and dotted.

* *hirundinis.* Wings tapering towards the extremity; legs terminating in six claws. 3. A native of Europe; on the bodies and nests of swallows.

* *ovina.* No wings. 4. A native of Europe; among the wool of sheep. The abdomen distended, pale, obtuse, marked on each side with a double waved white line, and on the back with a red spot; legs hairy, the claws set in pairs.

There have been only five species of this genus hitherto described.

VII. APTERA.

Wings none in either sex.

106. Lepisma.

Mouth furnished with four feelers, two setaceous, and two capitated. Lip membranaceous, round, and emarginated. Antennæ setaceous. Body covered with scales laid over one another, like tiles on the roof of a house. Tail furnished with bristles. Legs six, formed for running.

These in their various stages of existence prey upon sugar, decayed wood, and putrid substances. The larvæ and pupæ are six-footed, active, and swift.

Scaly, and resembling silver; tail triple. 1. A native of America; among sugar. They have been introduced into Europe, and are frequently to be met with among books and furniture. They run very quickly, and are not easily caught. Antennæ whitish, of the same length with the body. It is furnished with two scutella which enclose the thorax; two segments of the abdomen less than the rest; the tail furnished with three long bristles standing at a distance from each other, and with two pair of very small ones under the anus. * *saccharinum.*

Leaping; tail triple; segments of the abdomen hairy on each side beneath. 2. A native of Europe; in sandy situations, among stones and rubbish, and takes prodigious leaps by means of the springs under its tail; brownish, the antennæ the length of the body; the fore feet placed very near the mouth; each segment of the abdomen is furnished with a spine beneath. * *polypus.*

Naked; tail triple. 3. A native of Europe. It resembles the *podura*, but larger, wholly white, and cylindrical; the antennæ obtuse, and half the length of the body. *terrestre.*

There are seven species of this genus described by Gmelin.

107. Podura, *Spring-tail.*

Mouth furnished with four feelers, slightly clavated; the lip divided. Eyes two, composed of eight facets Tail forked, bent under the body, and acting like a spring. Legs six, formed for running.

The insects of this genus, through all their stages, feed on vegetables. The larva and pupa have six feet, and are active, and very much resemble the perfect insect.

Nearly globular, and green. 1. A native of Europe; on plants of different kinds, especially on the seminal leaves of the buck-wheat (*polygonium fagopyrum*). * *viridis.*

Oblong, and ash-coloured, with black marks. 6. A native of Europe; among bushes, in wood. It is frequently to be seen in the winter on the snow, in the footsteps of men and other animals. * *nivalis.*

Black, and lives in water. 12. A native of Europe. Assembles in troops, early in the morning, on the banks of pools and fish ponds. * *aquatica.*

White; lives on land. 13. A native of Europe; found very early in the spring on recently ploughed land. * *fimetaria.*

31 species of this genus have been described in the last edition of the System of Nature.

108. Termes, *White Ant.*

The mouth furnished with two jaws, formed of a horny substance. Lip formed likewise of a horny substance; is divided into four, the division linear and sharp. Feelers four, equal and filiform. Antennæ moniliform in most species. Eyes two.

These insects might with more propriety be placed under

under the order *Neuroptera*, or *Hymenoptera*, moſt of them having either two or four wings in the perfect ſtate. They are very deſtructive, and deſtroy proviſions, cloths, furniture, books, and timber of whatever magnitude, leaving a thin ſhell not thicker than paper; in houſes they are not only troubleſome, but dangerous, as they deſtroy the beams which ſupport the floors and roofs, and occaſion them to fall in.

fatale. Brown above; the thorax is compoſed of three ſegments; wings pale, furniſhed with a rib or nerve of a brick colour. 1. A native of India and Africa. Larva ſmall, about a quarter of an inch long, furniſhed with ſix feet, pale, with a roundiſh brick-coloured head, without eyes; mandible ſhort and ſtrong, antennæ as long as the thorax; the abdomen oval. Pupa larger; about half an inch long, with a very large oval poliſhed head, without eyes; jaws projecting, as long as the head, forked, without teeth, ſharp and black; thorax and abdomen paliſh. The perfect inſect both male and female has a brown head, antennæ yelloviſh and globular, prominent black eyes, the ſegments of the thorax margined, the abdomen variegated with white ſtreaks, wings twice the length of the body, legs yelloviſh. Of the white ant we have a very curious and intereſting deſcription, in the Philoſophical Tranſactions for 1781, by Mr Henry Smeathman of Clement's Inn. According to this account, the works of theſe inſects ſurpaſs thoſe of the bees, waſps, beavers, and other animals, as much at leaſt as thoſe of the moſt poliſhed European nations excel thoſe of the leaſt cultivated ſavages. With reſpect to the interior conſtruction, and the various members and diſpoſitions of the parts of the building, they may come into compariſon with ſome of the moſt celebrated works of man himſelf. The moſt ſtriking parts of theſe ſtructures are the royal apartments, the nurſeries, magazines of proviſions, arched chambers and galleries, with their various communications; the ranges of Gothic ſhaped arches, projected, and not formed by mere excavation, ſome of which are two or three feet high, but which diminiſh rapidly, like the arches of aiſles in perſpective; the various roads, ſloping ſtaircaſes, and bridges, conſiſting of one vaſt arch, and conſtructed to ſhorten the diſtance between the ſeveral parts of the building, which would otherwiſe communicate only by winding paſſages. In ſome parts near Senegal, their number, magnitude, and cloſe arrangement, make them appear like the villages of the natives. But theſe and many other curious inſtances of the great ſagacity and powers of theſe inſects cannot be underſtood, without viewing the plates in which their feeble frames, and comparatively, ſtupendous works are delineated. See Phil. Tranſ. above referred to. The economy of theſe induſtrious inſects appears to have been very attentively obſerved by the ingenious author, as well as their buildings. There are three diſtinct ranks or orders of them, conſtituting a well regulated community. Theſe are, firſt, the larvæ, labourers, or working inſects; ſecond, the pupæ, ſoldiers, or fighting order, who do no kind of labour, and are about twice as long as the former, and equal in bulk to about fifteen of them; and laſtly, the winged or perfect inſects, which may be called the nobility of the ſtate, for they neither labour nor fight, being ſcarcely able to defend themſelves. Theſe only are capable of being elected kings or queens; and nature has ſo ordered it, that they emigrate within a few weeks after they are elevated to this ſtate, and either eſtabliſh new kingdoms, or periſh within a day or two. The firſt order, the working, are moſt numerous, being in the proportion of 100 to one ſoldier. In this ſtate they are about a quarter of an inch in length, and twenty five of them weigh about a grain, ſo that they are not ſo large as ſome of our ants. See plate DI. fig. 1. and 2. The ſecond order, or ſoldiers, have a very different form from the labourers, and have been by ſome authors ſuppoſed to be the males, and the former the neuters; but they are in fact, the ſame inſects as the foregoing, only they have undergone a change of form, and approached nearer to the perfect inſect. They are now much larger, being half an inch long, and equal in bulk to 15 of the labourers, (fig. 3. and 4). The third order, the inſect in its perfect ſtate, varies its form ſtill more. The head, thorax, and abdomen, differ almoſt entirely from the ſame parts in the labourers and ſoldiers; and beſides this, the animal is now furniſhed with four fine large browniſh, tranſparent wings, with which it is at the time of emigration to wing its way in ſearch of a new ſettlement. It differs ſo much from the other two, that they have not hitherto been ſuppoſed to belong to the ſame community. In fact, they are not to be diſcovered in the neſt, till juſt before the commencement of the rainy ſeaſon; when they undergo the laſt change, which is preparative to the formation of new colonies. They are equal in bulk to two ſoldiers, and about 30 labourers (ſee fig. 5), and by means of the wings with which they are furniſhed, they roam about for a few hours, at the end of which time they loſe their wings, and become the prey of innumerable birds, reptiles, and inſects; while probably not a pair out of many millions of this unhappy race, get into a place of ſafety, fulfil the firſt law of nature, and lay the foundation of a new community. In this ſtate, many fall into the neighbouring waters, and they are eaten with avidity by the Africans The author found them delicate, nouriſhing, and wholeſome, without ſauce or other help from cookery, than merely roaſting them in the manner of coffee. The few fortunate pairs who happen to ſurvive this annual maſſacre and deſtruction, are repreſented by the author as being caſually found by ſome of the labourers, that are continually running about on the ſurface of the ground, and are elected kings and queens of new ſtates. Thoſe who are not ſo elected and preſerved, certainly periſh, and moſt probably in the courſe of the following day. By theſe induſtrious creatures, the king and queen elect are immediately protected from their innumerable enemies, by being incloſed in a chamber of clay, where the buſineſs of propagation ſoon commences; their voluntary ſubjects, then employed in conſtructing wooden nurſeries, or apartments entirely compoſed of wooden materials, ſeemingly joined together with gum. Into theſe, they afterwards carry the eggs produced from the queen, lodging them there as faſt as they can obtain them from her. The author even furniſhes us with plauſible reaſons to believe, that they here form a kind of garden for the cultivation of a ſpecies of microſcopical muſhrooms, which Mr Konig, in an Eſſay on the Eaſt Indian Termites, read before the ſociety of naturaliſts of Berlin, conjectures to be the food of the young inſects. But perhaps the moſt wonderful, and at the

ſame

ſame time beſt authenticated part of the hiſtory of theſe ſingular inſects, is that which relates to the queen or mother of the community in her pregnant ſtate. After impregnation, a very extraordinary change begins to take place in her body, or rather in her abdomen only. It gradually increaſes in bulk, and at length becomes of ſuch an enormous ſize as to exceed the bulk of the reſt of her body 1500 or 2000 times. She becomes 1000 times heavier than her conſort, and exceeds 20,000 or 30,000 times the bulk of one of the labourers. In this ſtate, the matrix has a conſtant periſtaltic or undulating motion, the conſequence of which is (as the author has counted them), (fig. 8.) the protruſion of a great many thouſands of eggs in twenty-four hours. Theſe eggs, ſays the author, are inſtantly taken from her body by her attendants, of whom there always are a great number in the royal chamber and the galleries adjacent, and carried to the nurſeries, which are ſometimes four or five feet diſtant in a ſtraight line. Here, after they are hatched, the young are attended and provided with every thing neceſſary, until they are able to ſhift for themſelves, and take their ſhare of the labour of the community. Many curious and ſtriking particulars are related of the great devaſtations committed by this powerful community, which conſtruct roads, or rather covered ways, diverging in all directions from the neſt, and leading to every object of plunder within their reach. Though the miſchiefs they commit are very great, ſuch is the economy of nature, that it is probably counterbalanced by the good produced by them, in quickly deſtroying dead trees, and other ſubſtances, which, as the author obſerves, would by a tedious decay, ſerve only to encumber the ſurface of the earth. Such is their alacrity and diſpatch in this office, that the total deſtruction of deſerted towns is ſo effectually accompliſhed, that in two or three years a thick wood fills the ſpace, and not the leaſt veſtige of a houſe is to be diſcovered. From the many ſingular accounts here given of the police of theſe inſects, we ſhall mention one reſpecting the different functions of the labourers and ſoldiers, or the civil and military eſtabliſhments in this community, on an attempt to examine their neſt and city.

On making a breach in any part of the ſtructure with a hoe or pickaxe, a ſoldier immediately appears and walks about the breach, as if to ſee whether the enemy has gone, or to examine whence the attack proceeds. In a ſhort time he is followed by two or three others, and ſoon after by a numerous body, who ruſh out as faſt as the breach will permit them, their numbers increaſing as long as one continues to batter the building. During this time they are in the moſt violent agitation and buſtle, while ſome of them are employed in beating with their forceps upon the building, ſo as to make a noiſe that may be heard at three or four feet diſtance. On ceaſing to diſturb them, the ſoldiers retire, and are ſucceeded by the labourers, who haſten in various directions to the breach, each with a burden of mortar in his mouth ready tempered. Though there are millions of them, they never ſtop to embarraſs each other; and a wall gradually ariſes that fills up the chaſm. A ſoldier attends every 600 or 1000 of the labourers, ſeemingly as a director of the works; for he never touches the mortar, either to lift or carry it. One in particular places himſelf cloſe to the wall which they are repairing, and frequently makes the noiſe above mentioned; which is conſtantly anſwered by a loud hiſs from all the labourers within the dome; and at every ſuch ſignal they evidently redouble their pace, and work as faſt again. The work being completed, a renewal of the attack conſtantly produces the ſame effects. The ſoldiers again ruſh out and then retreat, and are followed by the labourers loaded with mortar, and as active and diligent as before. Thus, ſays the author, the pleaſure of ſeeing them come out to fight or to work alternately may be obtained as often as curioſity excites or time permits; and it will certainly be found, that the one order never attempts to fight, or the other to work, let the emergency be ever ſo great. The obſtinacy of the ſoldiers is remarkable. They fight to the very laſt, diſputing every inch of ground ſo well as often to drive away the negroes, who are without ſhoes, and make the white people bleed plentifully through their ſtockings. Such is the ſtrength of the buildings erected by theſe puny inſects, that, when they are raiſed to little more than half their height, it is always the practice of the wild bulls to ſtand as centinels upon them while the reſt of the herd is ruminating below. When at their full height of ten or twelve feet, they are uſed by Europeans as places to look out from over the top of the graſs, which here grows to the height of thirteen feet, upon an average. The author has ſtood with four men on the top of one of theſe buildings, in order to get a view of any veſſel that might come in ſight. Theſe termites indeed are frequently pernicious to mankind, but they are alſo very uſeful and even neceſſary; one valuable purpoſe which they ſerve is to deſtroy decayed trees and other ſubſtances, which, if left on the ſurface of the ground in hot climates, would in a ſhort time pollute the air. In this reſpect they reſemble very much the common flies, which are regarded by mankind in general as noxious, and at beſt as uſeleſs beings in the creation; but it is certainly for want of conſideration. There are not probably, in all nature, animals of more importance; and it would not be difficult to prove, that we ſhould feel the want of one or two ſpecies of large quadrupeds much leſs than one or two ſpecies of theſe deſpicable looking inſects. Mankind, in general, are ſenſible that nothing is more diſagreeable than putrid ſubſtances, and nothing more peſtiferous.

Of a brick colour above; head black; antennæ yellow. 4. A native of America, Africa, and India. They build ſtrong oval neſts round the branches of trees. It very much reſembles the *T. fatale*, but is only half the ſize, the lower ſtemmata are impreſſed with a dot on the centre; wings browniſh, marked with a yelloviſh rib. Larva pale brown; head black, conic, and projecting forwards. *deſtructor.*

Black; ſegments of the abdomen tipt with white; legs pale. 5. A native of Africa; and reſembles in economy the *T. fatale*. It builds a neſt of a cylindrical ſhape, two or three feet high, of brown clay and vegetables mixed up together, with a round vaulted dome, ſurrounded by a prominent terrace. Larvæ or labourers have a pale head, without eyes; mandibles ſhort, furniſhed with teeth; thorax and abdomen oval, grayiſh lead colour; legs of a brick colour. Pupæ or guards have a very large brick-coloured head, clavated and ſwelling out before, oval and extended behind; *arda.*

mandible projecting and forked; antennæ of a brick colour, as long as the head, without eyes; thorax ſmall; abdomen oval, graviſh lead-colour; legs of a brick colour. Perfect inſect leſs than the former ones, with incumbent black wings, and pale brick-coloured legs.

mordax. Black; ſegments of the abdomen tipt with white; legs black. 6. A native of Africa. Builds cylindrical houſes. Larva and pupa like the laſt, but much leſs.

capenſe. Pale yellow; wings tranſparent, edged with brown. 7. A native of India and Africa. Larva furniſhed with two black eyes; and wanders about in the daytime in troops like the common ant.

fatidicum. Abdomen oval; mouth pale; eyes brown; antennæ ſetaceous. 3. A native of Europe.

* *pulſatorium.* Abdomen oblong; mouth red; eyes yellow; antennæ ſetaceous. 3. A native of Europe and America. Frequent in houſes, in old books, wood, decayed furniture, muſeums, and is rarely found with wings. The female beats like the ticking of a watch, and is often miſtaken for the *pinus pulſator*.

divinatorium. Abdomen tranſverſely furrowed; mouth brown; eyes black. 7. A native of Europe; found in books, and is very active and lively. Body whitiſh.

Theſe eight ſpecies are all that have been deſcribed by Gmelin: other two, the *morio* and *flavicolle*, have been deſcribed ſince.

106. Pediculus. *Louſe.*

Mouth furniſhed with a ſucker, which the inſect can ſtretch out or draw back at pleaſure; without feelers or proboſcis. Antennæ of the ſame length with the thorax. Eyes two. Abdomen flattiſh. Legs fix, formed for running.

The inſects of this genus live by ſucking the juices of animals. The larvæ and pupæ have ſix feet, and are active, reſembling the perfect inſect.

* *humanus* Abdomen aſh-coloured, and lobed. 1. There are two varieties of this ſpecies, the one ſofter and whiter, occupying the body and clothes, the other harder and darker-coloured occupying the heads of thoſe that do not attend to cleanlineſs, particularly of children.

The louſe which infeſts the human body makes a very curious appearance through a microſcope. It has ſuch a tranſparent ſhell or ſkin, that we are able to diſcover more of what paſſes within its body than in moſt other living creatures. It has naturally three diviſions, the head, the breaſt, and the tail-part. In the head appear two fine black eyes, with a horn that has five joints, and is ſurrounded with hairs ſtanding before each eye, and from the end of the noſe or ſnout there is a pointed projecting part, which ſerves as a ſheath or caſe to a piercer or ſucker, which the creature thruſts into the ſkin to draw out the blood and humour which are its deſtined food; for it has no mouth that opens in the common way. This piercer or ſucker is judged to be 700 times ſmaller than a hair, and is contained in another caſe within the firſt, and can be drawn in or thruſt out at pleaſure. The breaſt is very beautifully marked in the middle; the ſkin is tranſparent, and full of little pits: and from the under part of it proceed ſix legs, each having five joints, and their ſkin all the way reſembling ſhagreen, except at the ends, where it is ſmoother. Each leg terminates by two claws, which are hooked, and are of an unequal length and ſize. Theſe it uſes as we would a thumb and middle finger: and there are hairs between theſe claws as well as all over the legs. On the back part of the tail there may be diſcovered ſome ring-like diviſions, and a ſort of marks which look like the ſtrokes of a rod on the human ſkin: the belly looks like ſhagreen, and towards the lower end it is very clear and full of pits: at the extremity of the tail there are two ſemicircular parts all covered over with hairs, which ſerve to conceal the anus. When the louſe moves its legs, the motion of the muſcles, which all unite in one oblong dark ſpot in the middle of the breaſt, may be diſtinguiſhed perfectly, and ſo may the motion of the muſcles of the head when it moves its horns. We may likewiſe ſee the various ramifications of the veins and arteries, which are white, with the pulſe regularly beating in the arteries. But the moſt ſurpriſing of all the ſights is the periſtaltic motion of the guts, which is continued all the way from the ſtomach down to the anus. If one of theſe creatures be placed on the back of the hand, when hungry, it will thruſt its ſucker into the ſkin; the blood which it ſucks may be ſeen paſſing in a fine ſtream to the fore part of the head, where falling into a roundiſh cavity, it paſſes again in a fine ſtream to another circular receptacle in the middle of the head; from thence it runs through a ſmall veſſel into the breaſt, and then to a gut which reaches to the hinder part of the body, where, in a curve it turns a little upwards; in the breaſt and gut the blood is moved without intermiſſion with a great force, eſpecially in the gut, where it occaſions ſuch a contraction of the gut, as is very ſurpriſing. In the upper part of the crooked aſcending gut above mentioned, the propelled blood ſtands ſtill, and ſeems to undergo a ſeparation, ſome of it becoming clear and wateriſh, while other black particles are puſhed forwards to the anus. If a louſe is placed on its back, two bloody darkiſh ſpots appear, the larger in the middle of the body, the leſſer towards the tail: the dark bloody ſpot, in or over which the bladder ſeems to lie. This motion of the ſyſtole and diaſtole is beſt ſeen when the creature begins to grow weak; and on pricking the white bladder, which ſeems to be the heart, the creature inſtantly dies. The lower dark ſpot is ſuppoſed to be the excrement in the gut.

The poſterior part of the abdomen emarginated; legs formed like claws. 2. A native of Europe. It is found about the hairs of the groin, and ſometimes, though rarely, on the eyebrows of people who do not attend to cleanlineſs. The antennæ have five articulations; the hind part of the abdomen hairy. * *pubis.*

The abdomen orbicular, marked with a white line; ſcutellum compoſed of three lobes; the ſnout white. 3. A native of America. It gets into the legs of the naked inhabitants, where it draws blood, and depoſiting its eggs in the wound occaſions foul and malignant ulcers. *ricinoides.*

8. A native of Europe; on ſheep. * *ovis.*

The abdomen is marked with eight tranſverſe ruſty-coloured lines. 9. A native of Europe; on horned cattle. * *bovis.*

66 ſpecies of this genus are deſcribed in the laſt edition of the Syſtem of Nature, all of which occupy the bodies of different animals.

110. PULEX, *Flea*.

Mouth without jaws or feelers. The ſnout long, and bent inwards. A ſheath of two pieces, conſiſting of five articulations, covered at the baſe with two oval ſcales, and furniſhed with a ſingle briſtle. Lip round, fringed with ſharp points, which are bent backwards. Antennæ moniliform, projecting, and becoming thicker towards their outer ſide. Eyes two. Abdomen compreſſed. Legs ſix, formed for leaping.

The genus *pulex* is rather doubtful; it approaches in many reſpects to the inſects of the order hemiptera. They live on the juice and blood of other animals. Larva without feet, cylindrical, active, and furniſhed with two ſpines under the tail.

* *irritans*. The ſnout ſhorter than the body. 1. This familiar inſect is to be met with everywhere; it lives by ſucking the blood of other animals, and is very troubleſome to many of them, eſpecially to the hare and rabbit. They depoſit ſmooth round eggs at the roots of the hair of the animals on which they feed, on blankets, and articles made of wool, fur, &c. From theſe eggs are hatched the larvæ, reſembling ſmall white ſhining worms, which feed on the ſcurfy ſubſtance adhering to the cuticle of animals, or on the downy matter collected on clothes. About a fortnight after they are hatched, they acquire a conſiderable ſize, and become very active; when diſturbed they roll themſelves up into a ball. After they have acquired their full ſize, they retire into ſome undiſturbed ſituation; they form ſmall bags for themſelves compoſed of ſilky threads, which they ſpin from their mouths. Theſe bags are very white internally; but on the outſide, they are of the colour of duſt, and are very little diſcernible. They remain in the ſtate of pupa about 14 days. It continues to be of a white colour till the ſecond day before its eſcape from the bag, when it acquires a dark colour, becomes firmer, and is transformed into a perfect inſect.

The flea, when viewed in the microſcope, exhibits a very ſingular appearance. It is covered all over with black and hard ſcales, which are curiouſly jointed, and folded over one another, ſo as to comply with all the nimble motions of the creature. Theſe ſcales are poliſhed, and are beſet about the edges with ſhort ſpikes in a very beautiful and regular order. Its neck is finely arched, and ſomewhat reſembles the tail of a lobſter. Its eyes are very large and beautiful. The ſucker contains a couple of lances or darts; which, after the ſucker has made an entrance, are thruſt farther into the fleſh, to make the blood flow from the adjacent parts, and occaſion that round red ſpot, with a hole in the centre of it, which remains for ſome time after the puncture of a flea, commonly called *flea-bite*. A proper view of the ſucker with its two lances is not eaſily obtained, as the inſect puts out its ſucker only at the time of feeding. The beſt way of obtaining a view is to cut off the head, and ſubject it to the microſcope by itſelf. There is an hoſpital at Surat where a number of fleas are kept, and ſome poor creature, for pay, allows himſelf to be fixed down and fed upon by them.

Chiqur. Snout of the ſame length with the body. 2. A native of America. This inſect is very troubleſome in the ſugar colonies, penetrating into the feet of the inhabitants, where it lodges its eggs and cauſes malignant ulcers. Body reddiſh brown. The female produces a very great number of eggs, and when pregnant the abdomen ſwells to 100 times the ſize of the reſt of the body. It penetrates chiefly under the nails of the toes, and eats its way onwards, depoſiting its eggs, which are exceedingly minute, in a bag. It is diſcovered by the uneaſy itching it occaſions, and muſt be extracted with great caution and dexterity; for if the bag be burſt, and if any of the eggs or animals remain, a very troubleſome ulcer enſues, which ſometimes renders the limb uſeleſs. The ſlaves who go barefooted are chiefly expoſed to this calamity, and they are moſt dexterous at extracting them. *penetrans*.

There are only two ſpecies of this genus deſcribed in the laſt edition of the Syſtem of Nature publiſhed by Gmelin.

111. ACARUS, *Tick* or *Mite*.

Mouth without a proboſcis. The ſucker with a cylindrical ſheath, compoſed of two pieces. Feelers two, compreſſed, equal, and of the ſame length with the ſucker. Eyes two, placed on the ſides of the head. Legs eight.

The inſects of this genus are very minute, and very prolific; they abound everywhere; moſt of them live on the juices of other animals. The larva and pupa have ſix feet, (thoſe of the diviſion *trombidium* have eight feet); they are active, and very much reſemble the perfect inſect.

A. *The Antennæ are filiform, compreſſed, and of the ſame length with the Legs.*

Tranſparent; convex above and flattened beneath; marked in the middle with a blackiſh ſpot. 36. It is very common in waters, on the *mucus* which covers the ſpawn of frogs. Very ſmall, ſlow, inoffenſive, and legs terminating in three nails. *urſellus*.

Oval, almoſt globular; abdomen marked at the baſe with a round brown ſpot; antennæ clavated. 7. A native of Europe; it is very common on oxen and dogs. * *ricinus*.

Second pair of legs very thick. 8. A native of Europe; and very common. It is active, gregarious, frequently to be found in gardens among the earth in ſpring. * *craſſipes*.

Thorax angularly cruciform; the legs terminating in hooks, and longer than the body. 9. It is found on the body of the bat (*veſpertilio murinus*) of an uncommon figure, reſembling the *phalangium*. It cannot walk on a flat ſurface. * *veſpertilionis*.

Commonly called *Red Spider*. Tranſparent and red-diſh; the abdomen marked on each ſide with a brown ſpot. 14. A native of Europe; on various plants, particularly thoſe that are not expoſed to the weather, or ſhut up in hot-houſes. It forms webs of parallel threads, by which it ſometimes ſuffocates plants in green-houſes. *telarius*.

It is frequently to be found on the leaves of the lime-tree in autumn.

* *siro.* *Cheese-Mite.* Whitish; head and thighs of a rusty colour; the abdomen bristly. 15. A native of Europe; in flour, cheese, &c. which have been long kept. The cheese mite is a very minute species; to the naked eye they appear like moving particles of dust. But the microscope shows them to be perfect animals, having as regular a figure, and performing all the functions of life as perfectly, as creatures that exceed them far in size. The head is small in proportion to the body, and has a sharp snout; they have two small eyes, and are very quick-sighted, when they have once been touched by a pin, they artfully avoid another touch. The extremity of their legs are furnished with two little claws, with which they take hold of any thing. The hinder part of the body is plump and bulky, and ends in an oval form, from which issue out some long hairs. Other parts of the body are thinly beset with long hairs. The males and females are easily distinguished. The females are oviparous; and from their eggs the young ones are hatched, in the space of 12 or 14 days in warm weather, but in colder weather longer time becomes requisite. They are very minute when first hatched, and cast their skin several times before they arrive at their full growth, but do not materially change their appearance. They are very tenacious of life, and may be kept alive several months without food. Mr Leeuwenhoek had one that lived 11 weeks on the end of a pin, on which he had fixed it for microscopical observations. They may be kept a long time between two concave glasses, and occasionally subjected to the microscope. In this way they may be seen *in coitu*, conjoined tail to tail, and this is performed by an incredibly swift motion. They are very voracious animals, and have been often seen eating one another. Their manner of eating is by thrusting one jaw forward and drawing the other back alternately, and in this manner, as it were, grinding their food; after they have done feeding they seem to ruminate.

* *scabiei.* *Itch-insect.* White; legs reddish; the four posterior legs are furnished with a very long bristle. 50. In the pustules occasioned by the itch. It is generally thought to be the cause of the itch, though some hold a contrary opinion; the manner, however, in which the itch is communicated, seems to confirm the former opinion.

* *lactis.* Abdomen oval and obtuse, furnished with four bristles the same length with the body, which incline downwards. 16. It is found in cream that has been long kept, and in milk vessels that have not been kept clean.

dysenteriæ Legs furnished with two bristles; the abdomen oval, furnished behind with four horizontal bristles of the same length with the body. 17. It is found in casks and vats, in which beer has been kept; they are most frequently found about the top or near any chink in the vessel; they are likewise found very frequently within the cask, and are said to walk about on the top of the beer from 10 o'clock at night till 10 o'clock in the morning; during the day they conceal themselves in the chinks of the cask.

* *baccarum.* The abdomen turgid and red, and dark-coloured on the sides. 23. It is found on the fruit of the corinth and gooseberry.

The abdomen reddish; the hind-legs very long and filiform. 24. A native of Europe; on different species of flies. * *muscorum.*

Abdomen red, marked on each side with scarlet dots. 26. It is to be found on bees, wasps, dragon-flies, &c. * *gymnopterorum.*

Oval, and reddish; the anus whitish. 27. It is found on many insects, particularly on the common black beetle; which, on that account, has been called the *lousy beetle:* they run very quickly. * *coleoptratorum.*

The posterior part of the abdomen crenated; the scutellum oval, and somewhat tawny; the snout divided into three. 6. A native of America; they fix on the legs of travellers and suck the blood; they adhere so closely, that they are removed with difficulty; the fore-legs are furnished with short prickles, near their junction with the body. *sanguisugus.*

The first pair of legs very thick, and furnished with claws; the second pair very long, and furnished with two bristles at the extremity. 62. Found in books kept in damp places, particularly about the backs, where the sheets have been glued together. It is very injurious, and not visible without the help of a glass. *cruditus.*

Hemispherical, pale, and smooth. Legs equal. 31. It is found in troops on the body of the *acarus crassipes.* *acarorum.*

Oval; furnished with several long hairs at the extremity of the abdomen; the legs are furnished with a single bristle. 61. Found on the bodies of insects and other subjects of natural history which are kept in too moist places, and is more destructive to museums than even the *ptinus fur*, and not visible to the naked eye. *destructor.*

B. *Antennæ setaceous.* Trombidia.

The abdomen hairy, red, and obtuse behind; the fore legs whiter than the rest. 20. A native of Surinam and Guinea; very hairy; it becomes white when immersed in spirits of wine. *tinctorius.*

The abdomen of a blood colour, flat, and downy, turned up behind. 22. A native of Europe and America; is said to be poisonous if swallowed. * *holosericeus.*

82 species of this genus have been described in the last edition of the System of Nature.

112. Hydrachna.

Head, thorax, and abdomen united. Feelers two, jointed. Eyes two, four, or six. Legs eight.

The insects of this genus are inhabitants of the water, swim with great velocity, and prey on the larvæ of *tipulæ* and *monoculi*. They deposit red spherical eggs, which in about a month acquire a lunar form, and produce six-footed larvæ furnished with a single proboscis, which, after they have changed their skin several times, become perfect insects furnished with eight feet.

A. *Eyes two.*

* *Those which are furnished with a Tail.*

Globular; eyes red. 1. It is to be found in ditches containing water; male greenish and spotted; female bluish and without spots, and double the size of the male. * *globator.*

Oval,

buccinator. Oval, red, and black behind; furniſhed with a yellow cylindrical tail, and ſtraightened at the baſe. 3. It is found on the banks of rivers; black beneath, eyes reddiſh, legs black.

fatillator. Purple and globular, furniſhed with a papilla on each ſide of the tail; legs black. 12. It is to be found early in the ſpring in overflowed meadows.

** Furcatæ. *Back marked with a fork.*

craſſipes. White and oval; the diſk black and marked with a reddiſh fork, and furniſhed with papillæ near the anus; fore legs thick. 13. It is found in fiſh ponds and ditches containing water; the legs twice or thrice the length of the body, which renders it eaſily to be diſtinguiſhed. It is tranſparent; breaſt whitiſh; eyes black; when walking freely, it directs its legs forwards; after it has gone a few ſteps, it extends its legs horizontally, and reſts as if it were dead, and a little afterwards it renews its motion.

clavicornis Reddiſh and oval; marked with a yellow fork, feelers clavated, legs pale. 15. It is found in marſhes; eyes ſmall and black, feelers and legs white.

*** *Glabræ.*

deſpiciens. Round and red, marked with ſeveral ſpots; the eyes placed on the under part of the body. 23. It is to be found in ditches full of water; it reſembles the *H. maculata* in every reſpect, except the poſitions of the eyes; flattiſh, wrinkled, full of dimples, marked with nine ſpots; eyes blackiſh; legs yellowiſh.

verſicolor. Nearly ſquare, marked with white, blue, and brown ſpots. 44. It is found in places overflown with water; white above, brown beneath, edge yellowiſh; the feelers and legs white and tranſparent.

B. *Eyes four.*

calcarea. Round, brown, and very white in the middle. 45. It is to be found, though rarely, in moiſt places; eyes black, feelers pointed, legs pale and tranſparent.

maculata. Oval and red; marked on the back with black ſpots. 48. It is found in wet ditches; ſhining; eyes black; legs yellow and tranſparent; feelers yellow, ſometimes long, ſometimes ſhort.

C. *Eyes ſix.*

* *umbrata.* Round and red, marked with ſeveral ſpots. 49. It is found in woody marſhes; ſmooth, ſomewhat depreſſed, marked with more than ten obſcure ſpots, blackiſh beneath; eyes black; feelers very ſmall, tipt with black; legs yellow.

49 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

93. PHALANGIUM.

Mouth furniſhed with two filiform feelers; the mandible compoſed of a ſubſtance like horn; the ſecond joint furniſhed with a ſharp tooth, moveable, and furniſhed with a claw. Antennæ none. Two eyes on the top of the head contiguous, and two lateral eyes. Legs eight. Abdomen (for the moſt part) round.

The inſects of this genus in their various ſtages of tranſformation prey on the ſmaller inſects and worms; the larvæ have eight feet, active, and reſemble the perfect inſect.

A. *Sucker, a conical tube.* Pycnogona.

Feelers four; body filiform; legs very long. 1. A native of the north of Europe; found on the Norwegian ſeas; very ſlow, and very minute; it is compoſed of ſeveral articulations, and has a very narrow linear tail; it enters the ſhells of muſcles, and conſumes their contents. * *groſſipes.*

Feelers two; body oval. 6. It is found in the north ſeas, under ſtones; it is red on the back, the ſucker projecting, ſtraight, obtuſe at the extremity, and perforated with a round entire perforation; the feelers inſerted at the baſe of the ſucker, and almoſt equalling it in length; the legs jointed and angular. * *balænarum.*

B. *Without a ſucker.*

Body oval and black; the under part of the body and legs pale. 10. A native of Europe; it is to be found on rocks. *morio.*

Long-legged ſpider, or *ſhepherds ſpider.* Abdomen oval and gray, beneath white. A native of Europe and America; wandering about in the night time. * *opilio.*

Abdomen inverted, oval and flattiſh; claws ſmooth, the fingers hairy. 4. A native of Europe; in confined ſhaded places, in boxes and damp cellars; it feeds on *termites* and *mites*, and moves like a crab; it is deſtructive to collections of dried plants; it likewiſe enters the ſkin of the human body, and excites a very painful pimple about the ſize of a pea. * *cancroides.*

Abdomen cylindrical, the claws ſmooth; head furniſhed with an appendage. 5. A native of America; in confined places in tropical countries. Its bite is ſaid to be dangerous; yellowiſh, the claws oval. *acaroides.*

Claws notched, and hairy; body oblong. 15. A native of Italy, Africa, Perſia, and the ſouthern ſhores of the Volga; its bite occaſions very violent pain, livid tumors, delirium, and ſometimes death; ſoft, lurid, and woolly; the claws very turgid. *araneoides.*

15 ſpecies of this genus have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature.

114. ARANEA, *Spider.*

Mouth furniſhed with ſhort horny jaws; the lip round at the tip. Feelers two, bent inwards; jointed and very ſharp at the extremity: in the males they are clavated, and have the organs of generation placed in them. Antennæ none. Eyes eight; ſometimes ſix, though ſeldom. Legs eight. The anus is furniſhed with papillæ, with which the inſect ſpins threads, and forms its web.

Theſe inſects, through every ſtage of their exiſtence, prey upon other inſects, eſpecially thoſe of the order *Diptera*; they even do not ſpare thoſe of their own genus or ſpecies: from the papillæ at the end of the abdomen they throw out at pleaſure a number of fine threads, which they unite in various ways for the purpoſe of entangling their prey. They every year caſt their old ſkin, which they perform by ſuſpending themſelves in ſome ſolitary corner, and creeping out of it. The young ones have the power of aſcending the air to

a great height; to accompliſh which, they climb up ſome eminence, and are wafted about by the winds, filling the air with their threads. They are deſtroyed by the ſphex and ichneumon.

Linnæus has ſubdivided this genus according to the number and poſition of their eyes.

A. *Eyes eight.*

1. *Eyes placed thus,* ⁘

faſciata. Of a ſilver colour; the abdomen marked with yelloviſh bands; the legs ſurrounded with brown rings. 48. A native of the iſland of Madeira.

* *diadema.* Abdomen nearly globular and reddiſh; brown, marked with a white croſs compoſed of dots. 1. A native of Europe, on trees; it is a very beautiful inſect.

* *aquatica.* Brown; abdomen oval and of an aſh colour; the back brown, marked with two dots. 39. A native of Europe, in ſtagnant waters, where it dives to the bottom in ſearch of its food. It takes up its winter quarters in an empty ſnail ſhell, the aperture of which it cloſes up with a web; jaws black, claws red.

2. *Eyes placed thus,* ⁘

latro. Thorax hairy, and of an aſh colour; the abdomen oval, black, and ſpotted with red. 65. A native of America; large, the thorax oval, legs black, thighs pale.

* *domeſtica.* Abdomen oval and brown, marked with five black ſpots nearly contiguous, the anterior ones larger than the others. 9. A native of Europe, in houſes, and about windows; feeds chiefly on flies.

3. *Eyes placed thus,* ⁘

* *globoſa.* Black; ſides of the abdomen of a blood red colour. 69. A native of Europe, in meadows.

4. *Eyes placed thus,* ⁘

argentata. Abdomen white, and brown behind, and marked round the edge with ſix ſmall projections. 70. A native of South America.

5. *Eyes placed thus,* ⁘

fumigata. Abdomen oval and brown, marked at the baſe with two white dots. 16. A native of Europe, in meadows; it watches near the neſts of the larvæ of different inſects, and waits their coming out, when it ſeizes on one after another, and ſucks out their ſubſtance.

* *faccata.* Abdomen oval, of a browniſh colour. 40. A native of Europe, in gardens, and carries its eggs behind it encloſed in a bag; legs livid, marked with unequal brown rings ſet cloſe together.

6. *Eyes placed thus,* ::::

extenſa. Abdomen long, of a ſilver colour tinged with green, the legs extended longitudinally. 22. A native of Europe, in woods; its legs are applied cloſely to the branches.

nidulans. Shining black; the abdomen hairy and black. 73. A native of America; it forms a neſt under ground, and ſpins a large cylindrical web, which is covered with a lid; its bite is very painful, and frequently occaſions fever and delirium, which is ſoon removed by a gentle ſudorific; thorax marked with a large depreſſed circular ſpot; abdomen oval; legs equal.

7. *Eyes placed thus,* ⁘

Black, thorax marked with a white line on the back. * *dorſalis.* 79. A native of Britain.

Marked with triangular black ſpots on the back of the abdomen; the legs ſpotted with black. 34. A native of the ſouth of Europe, particularly Italy and Barbary. It is found in caverns in argillaceous ſoil; its bite was formerly ſuppoſed to be curable by nothing but muſic; though it occaſions a great deal of pain, it is almoſt never fatal. *tarantula.*

8. *Eyes placed thus,* ⁘

Oval and oblong; thorax hairy, white; abdomen and legs black, marked with yellow bands. 33. A native of Europe. *pulchra.*

9. *Eyes placed thus,* ⁘

Black, abdomen oval, forehead white, and leaps on its prey. 84. It is to be found frequently in woods about Vienna; abdomen marked with two compreſſed dots. *goezii.*

10. *Eyes placed thus,* ⁘

Thorax orbicular and convex, with a tranſverſe central excavation. 31. It is a native of South America, among trees, where it preys upon the larger inſects, and even ſmall birds, dropping into their neſts and ſucking their blood and eggs; it is of ſo enormous a ſize that its fangs may be compared to the talons of a hawk, and its eyes are very large. *avicularia.*

11. *Eyes placed thus,* ⁘

Of a grayiſh ruſty colour, and ſlightly clouded; thorax globular, and ſlightly heart-ſhaped; abdomen ſomewhat triangular, and marked with a faint longitudinal croſs. 85. A native of Europe, on oak and other trees; abdomen marked with four impreſſed dots on the back; papillæ three. *truncata.*

12. *Eyes placed thus,* ⁘

Abdomen oval, obtuſely conic behind, variegated with brown and white; beneath black. 86. A native of Europe, among buſhes; it ſpins and ſpreads out a web, to the ſurface of which it attaches the inſects it has enſnared, after it has ſucked out their juice. Thorax black, ſlightly tinged with ruſty colour, and nearly double behind; legs gray, marked with brown rings; abdomen marked with a whitiſh ſpot, beneath reſembling a horſe ſhoe; papillæ four. *conica.*

13. *Eyes placed thus,* ⁘

Hairy; body oval, black, variegated with brown. 99. A native of Europe. *albifrons.*

B. *Eyes ſix, placed thus,* ⁘

Abdomen greeniſh, the ſides yellow. 30. A native of Europe; in gardens. * *ſenoculata.*

C. *Eyes*

C. *Eyes* - - - - -

* *holoſericea.* Abdomen oval, oblong, and ſilky; marked underneath near the baſe with two yellow dots. 29. A native of Europe. It is found within the leaves of plants which it rolls up.

venatoria. Thorax orbicular, ſmooth and black; abdomen oval, downy and brown. 33. A native of America. It conſtructs a tenacious cylindrical neſt about a foot in length, furniſhed with a lid.

96 ſpecies of this genus have been deſcribed by Gmelin, in the laſt edition of the Syſtem of Nature.

115. SCORPIO, *Scorpion.*

Legs eight; likewiſe two claws ſituated on the fore part of the head. Eyes eight; three placed on each ſide of the thorax, and two on the back. Feelers two, furniſhed with claws, and projecting. Lip bifid. Antennæ none. Tail long, jointed, terminating in a ſharp crooked ſting. On the under ſide, between the breaſt and abdomen, are two excreſcences reſembling combs.

Scorpions have been conceived to be the moſt malignant and poiſonous of all animals. Though this opinion be now very generally exploded, there are none of the inſects we are acquainted with ſo formidable. It is true the effect of their ſting differs greatly, according to the circumſtances of the conſtitution of the perſon receiving the wound, as well as of the animal itſelf, the heat of the climate in which it lives, and the degree of violence with which the wound may have been inflicted.

The common European ſcorpion certainly is not of ſo terrible a nature as is commonly ſuppoſed; its ſting being very rarely productive of bad conſequences. But the large ſcorpions of Africa, which are ſaid to be nearly a foot in length, may well be ſuppoſed capable of inflicting a wound of the moſt ſevere pungency, and of the moſt dreadful malignity. The poiſon is evacuated through three very ſmall *foramina* near the tip of the ſting; viz. one on each ſide of the tip, and the other on the upper part. A diverſity of opinion has ſubſiſted among naturaliſts, relative to the ſlit or foramen in the fangs of ſpiders, through which their poiſon is evacuated; and the ſame variety of opinion has prevailed with reſpect to the *foramina* in the ſcorpion's ſting. The celebrated Redi, aſſiſted by the beſt microſcopes he could procure, was not able to diſcover them, though he was well convinced of their exiſtence, from having perceived the minute drop of poiſon exſude from near the tip of the ſting. Others have denied the exiſtence of the foramina; but Valiſnerius and Leeuwenhoek have both deſcribed two, viz. one on each ſide of the tip, and which in ſhape are inclining to triangular; beſides theſe a third has ſometimes been ſeen, ſo that the ſting of the ſcorpion can with greater facility diſcharge its venom, than that of any other animal. The poiſon is whitiſh, and is contained in a ſmall bladder near the tail. When this bladder is preſſed, the poiſon may be ſeen iſſuing out through the foramina of the ſting.

Maupertuis has made many experiments with the ſcorpion of Languedoc, the reſults of which were by no means uniform. He provoked one to ſting a dog in three places of the belly, where the animal was without hair. In about an hour after the animal ſeemed greatly ſwollen and very ſick. He then caſt up whatever he had in his bowels, and for about three hours continued vomiting a whitiſh liquid. The belly was always greatly ſwollen when the animal began to vomit, but this operation always ſeemed to abate the ſwelling; thus alternating for the ſpace of three hours. The poor animal after this fell into convulſions, bit the ground, dragged himſelf along on his forefeet, and at length died five hours after he had been ſtung. There was no partial ſwelling round the wound inflicted, as is uſual after the ſting of a waſp or bee; but the whole body was inflated, and there only appeared a red ſpot on the places ſtung. Two days afterwards the ſame experiment was tried on another dog, and even with more aggravated cruelty; yet the dog ſeemed no way offended by the wounds, but howling a little when he received them, continued alert and well after them, and ſoon after was ſet at liberty, without ſhewing the ſmalleſt ſymptoms of pain. The experiment was repeated with freſh ſcorpions upon ſeven other dogs, and three hens, but not the ſmalleſt deadly ſymptom was ſeen to enſue. He put three ſcorpions and a mouſe into the ſame veſſel, and they ſoon ſtung the little animal in different places. The mouſe thus aſſaulted, ſtood for ſome time on the defenſive, and at laſt killed them all one after another, and did not ſeem to have received any material injury itſelf, at leaſt no fatal conſequences followed, though it had received ſeveral ſevere wounds. From hence it appears, that many circumſtances which are utterly unknown muſt contribute to give efficacy to the ſcorpion's venom. Whether the nature of its food, long faſting, the ſeaſon, age of the inſect, or the part of the body which it wounds, add to or diminiſh the malignity of the poiſon, ſtill remains to be aſcertained. The inſects employed by Maupertuis were newly caught, ſeemingly vigorous, and were of different ſexes. The reſult of theſe experiments may ſerve to ſhew, that many of the boaſted antidotes which are given for the cure of the ſcorpion's ſting, owe their ſucceſs more to accident than to their own efficacy. The ſcorpions of tropical climates are very large, and perhaps more venomous. Helbigius, who reſided long in the eaſt, ſays that he was often ſtung by the ſcorpion, and never ſuffered any material injury from the wound, though a painful tumor generally enſued, which was cured by rubbing with a piece of iron or ſtone, as he had ſeen the Indians do, until the part became inſenſible. Seba, Moore, and Boſman, give a very different account of the ſcorpion's malignity; and aſſert that without the ſpeedy application of proper remedies, the wound proves fatal. Several fabulous anecdotes have been recorded of theſe animals by the older writers on natural hiſtory, which are totally unworthy of notice. The moſt remarkable of theſe is, that ſcorpions ſometimes commit ſuicide, when they find themſelves in a ſituation from which they cannot make their eſcape. It is ſaid that a newly caught ſcorpion, placed in a circle formed with pieces of burning charcoal, runs round endeavouring to effect its eſcape, but finding no exit, it applies its tail to the back part of its head, and ſtings itſelf to death. Scorpions are viviparous, and produce about forty or fifty young ones at a time, which are completely ſhaped, and undergo no further change, except caſting their ſkin from time to time like ſpiders. They feed on flies, ſpiders, worms, &c. and even on one another.

The

auſtraliæ. The comb-like excreſcences placed between the breaſt and abdomen, compoſed of ſix teeth; claws ſmooth. 7. A native of the South ſea iſlands.

maurus. Comb compoſed of eight teeth; claws nearly heart-ſhaped and pointed, 1. A native of Africa.

carpathicus. Combs compoſed of ſix teeth; claws nearly heart-ſhaped and ſmooth. 2. It is found on the Carpathian mountains, and in Switzerland.

afer. Combs furniſhed with thirteen teeth; claws nearly heart-ſhaped and hairy. 3. A native of India and Perſia; and is the largeſt and moſt formidable ſpecies.

americanus. Combs furniſhed with fourteen teeth; the claws fringed with hair; toes filiform. 4. A native of South America. It is eaten by the natives of California.

chilenſis. Combs furniſhed with ſixteen teeth; claws ſomewhat angular. This is a variety of the former.

europæus. Combs furniſhed with eighteen teeth; claws angular. 5, A native of the ſouth of Europe and north of Aſia. It is viviparous.

hotentotus. Combs furniſhed with twenty-two teeth; claws ſmooth; the tail rough. 8. A native of Africa, in the neighbourhood of Sierra Leone. Body of a dark brown colour, and marked with raiſed lines; legs pale.

auſtralis. Combs furniſhed with thirty-two teeth; claws ſmooth. 6. A native of Africa.

Theſe are all the ſpecies of the ſcorpion that have been deſcribed in the laſt edition of the Syſtem of Nature.

116. CANCER, *Crab.*

Legs eight, (ſeldom ſix or ten), likewiſe two claws. Feelers ſix, unequal. Eyes two, placed at a diſtance from one another, and ſet on moveable ſtalks in moſt ſpecies. Mandible compoſed of a horny ſubſtance, and thick. The lip triple. The tail jointed and without a ſting.

Theſe live chiefly in water; and feed on inſects, worms, dead fiſh, and dead bodies of any kind. They every year caſt their ſhell, which is performed with much difficulty and pain; and during the change they become weak and ſickly.

A. *Antennæ four.*

† *The laſt articulation bifid; the Tail ſhort.*

‡ *The Thorax ſmooth,*

|| *And entire on the ſides.*

curſor. The poſterior parts of the ſides of the thorax furniſhed with ſharp points; the tail bent back. 1. A native of the Mediterranean and Indian ſeas. About ſunſet it leaves the water, and runs about the ſands with great velocity.

pennophylax. Thorax orbicular, unequal and fringed; four dorſal legs. 5. A native of America, within the ſhell of the *bhama lazarus*, to which it gives notice of the approach of the cuttle-fiſh.

* *piſum.* Thorax orbicular, obtuſe; the tail of the ſame length with the body. 6. A native of the Mediterranean ſeas. About the ſize of a pea; the tail very obtuſe; the legs ſmooth and without ſpines; claws ſomewhat oblong; toes equal.

* *minutus.* Thorax nearly ſquare; edge ſomewhat ſharp; the legs compreſſed. 8. It is found in the open ſea, particularly on the *fucus natans*, and runs about on the ſurface of the water.

pinnotheres. Very ſmooth; the anterior part of the thorax flattened on the ſides; the tail is carinated and knobbed in the middle. 9. A native of the Aſiatic ſeas. It reſides within the ſhell of the *pinna*. The ancients ſuppoſed that this was a friendly connection formed for mutual defence: that the *pinna* being deſtitute of eyes, and thus expoſed, when he opened his ſhell, to the attacks of the cuttle-fiſh and other enemies, was warned of their approach by his little lodger, on which he immediately ſhut his ſhell, and both were ſafe.

ruricola. *Land crab.* The firſt joint of the legs prickly; the ſecond and third joints ſet with tufts of hair. 11. A native of South America. This ſpecies reſides in the woods. In the Bahama iſlands they are ſo numerous that the ground ſeems to move as they crawl about. At breeding time they generally make to the ſea ſhores, for the purpoſe of waſhing off their ſpawn, and depoſiting it in the ſand, and no obſtruction will make them turn aſide from the ſtraight road, when they are on their progreſs towards the ſea. They are eſteemed very excellent food. They feed on vegetables, but when they have fed on the manchineel apple, they are reckoned poiſonous. When taken, they will ſeize the perſon's finger with their claw, and endeavour to eſcape, leaving the claw behind, which for the ſpace of a minute after it has been ſeparated from the body, continues to ſqueeze the finger cloſely. They vary in ſize and colour; the light-coloured ones being eſteemed the beſt food.

|| || *Thorax marked along the ſides with inciſions.*

vocans. Thorax marked with one ſmall projection, one of the claws larger than the other; the eyes long. 14. A native of Jamaica. It conceals itſelf under ſtones, and utters a cry when caught, and pinches ſeverely.

* *angulatus.* The thorax furniſhed with two projections on each ſide; claws very long. 110. A native of England. Found in the ſea near Weymouth. The claws are three times the length of the body.

dromia. Hairy; thorax notched on both ſides; the hind-legs terminating in two nails. 24. A native of the Indian ſeas. Black; the extremities of the claws ſmooth and white. It is reckoned poiſonous.

* *pagurus.* *Common Crab.* Thorax marked on each ſide with nine obtuſe folds; the tips of the claws black. 27. A native of both the European and Indian ſeas. This is the crab moſt generally uſed in this country for the table; they are in ſeaſon and heavieſt in the ſummer; and caſt their ſhells in the winter and ſpring. They frequent rocky ſhores.

‡ ‡ *Thorax hairy or prickly on the upper ſide.*

* *araneus.* Thorax hairy, marked with knobs and oval; furniſhed with a beak which is divided at the extremity; claws oval. 30. A native of the European ſeas. This ſpecies is ſuppoſed to be injurious to oyſterbeds; on this account the fiſhermen, when they meet with them in the courſe of dredging, are careful not to return them into the water, but carry them on ſhore, and deſtroy them.

Thorax

maja. Thorax prickly; claws turgid and covered with ſpines; the fingers of the claws covered with tufts of hairs; legs ſix. 41. A native of the Norwegian ſeas.

**horridus.* The thorax ſet with ſpines, and covered with knobs; claws oval; tail carious. 43. A native of the Aſiatic and Norwegian ſeas. There is a large variety of this found on the eaſt coaſt of Scotland, which has its legs and claws covered with ſpines.

§§ *Antennæ ſet on ſtalks; the laſt articulation of the poſterior pair bifid; Tail long and without leaves.* Paguri Fabricii. Paraſitici.

latro. Thorax divided into four; the tail ſimple and big-bellied beneath. 56. A native of Eaſt India. In holes of rocks. Wanders about on land by night in ſearch of cocoa-nuts, on which it feeds. To procure them it mounts the trees, and having detached the nuts, and let them drop to the ground, it deſcends and tears them open with its claws. This ſpecies is eatable, except the inteſtines.

bernhardus. Claws heart-ſhaped, and covered with ſharp points; the claw on the right ſide larger than the other. 57. A native of the European ſeas. This ſpecies being deſtitute of ſhell towards the tail, takes poſſeſſion of the empty ſhells of different ſpecies of cochlea, changing from one to another as it increaſes in ſize; the tail, which is ſoft and without a ſhell, is furniſhed with a hook to ſecure itſelf in its habitation.

diogenes. Claws ſmooth and downy; the claw on the left ſide larger than the other. 53. A native of the American and Aſiatic ſeas. It occupies the empty ſhells of different ſpecies of cochlea.

caput mortuum. Downy, covered with a hemiſpherical cap. A native of the Mediterranean ſea. It is of a dirty gray colour; hemiſpherical and without ſpines. It very much reſembles a ſcull or death's head, whence it has received its name; it is about the ſize of a cheſnut. The cap proceeds, as it were, from the hind-legs, and is turned over the body; the fingers of the claws equal and naked at the tips; the extremity of the legs ſharp.

**araneiformis.* Claws rough; the tail callous at the extremity, and furniſhed with a hook. 143. It is found in the fiſſures of the rocks on the ſea-ſhore near Edinburgh. It occupies the empty ſhells of the *nerita* or *turbo*.

**rugoſus.* Thorax wrinkled, ciliated, and prickly on the fore part; the beak furniſhed with three ſmall projections, the claws filiform. 149. A native of the Mediterranean and north ſeas. It is found on the ſea-ſhore near Banff in Scotland. This is the *C. banffius* of Pennant, and the *C. brachiatus* of Shaw.

§§§ *Antennæ ſet on ſtalks, the poſterior pair cleft; Tail long.*

‡ *The ſhell of the Thorax covering the Thorax completely.* Aſtaci. Lobſters.

|| *The poſterior Antennæ bifid.*

**gammarus.* *Lobſter.* Thorax ſmooth; the beak notched on the ſides, marked on the upper ſide, at the baſe, with a double tooth. 62. It inhabits the ſea, on rocky ſhores. This is reckoned the moſt delicate ſpecies; and is moſt in requeſt for the table. They chiefly frequent deep clear water. They are taken in wicker-baſkets, with holes on the ſides, which allow the lobſters to enter, and prevent their egreſs; or with ſmall nets attached to iron hoops. They breed in the ſummer months, and depoſit many thouſands of eggs in the ſand. They caſt their ſhell annually, and when any of their legs or claws happen to be torn off they grow again. They are in ſeaſon from October to May. Lobſters are ſaid to be very much alarmed at thunder, ſo much ſo as ſometimes to caſt their claws.

Craw-fiſh. Thorax ſmooth, the beak notched on the ſides, with a ſingle tooth on each ſide at the baſe. 63. It inhabits freſh waters; it lodges in holes in the clayey banks of rivers or lakes. It is reckoned a delicacy, and is much in requeſt as food. **aſtacus.*

Antennæ projecting; beak tapering towards the extremity; eyes globular and prominent. 156. A native of the north ſeas. This little animal is very abundant, and is the principal food of the herrings and cod-fiſh. **balecum.*

||| *The poſterior Antennæ divided into three.*

Prawn. Thorax ſmooth; the beak ſerrated above, beneath furniſhed with three ſmall projections; the edge of the thorax furniſhed with five ſmall projections. 66. A native of the European ſeas. The beak is ſometimes ſtraight, ſometimes crooked. There is a ſmaller variety of this, called in London the *white ſhrimp*, which is white when boiled. Prawns are much reliſhed by moſt people; and are very abundant in ſandy ſhores. **ſquilla.*

Shrimp. Thorax ſmooth; beak ſhort and entire; the moveable toe of the claw longer than the other. 67. A native of the northern ſeas. This ſpecies is reckoned the moſt delicious of the genus. It is very plentiful on the ſandy ſhores of Britain. **crangon.*

‡‡ *The ſhell of the Thorax not covering the Thorax completely.* Squillæ Fabricii.

Claws furniſhed with a ſingle fang, crooked, compreſſed, and notched; without a moveable toe. 76. A native of the Mediterranean and Aſiatic ſeas. It is reckoned a delicacy by the Italians. *mantis.*

|||| *Antennæ ſet on ſtalks, and ſimple.* Gammari Fabricii.

Claws conſiſting of a ſingle fang; legs fourteen; the thighs of the hind-legs compreſſed and dilated. 170. A native of the north ſeas. Large, almoſt white; the beak ſhort, curved, and ſharp; the tail compoſed of ſix leaves or plates; the laſt articulation bifid. *ampulla*

Claws four, furniſhed with a ſingle fang, and deſtitute of a moveable toe; legs ten. 81. A native of Europe. It is frequent on the ſea-ſhore, in wells, ditches, rivulets, and likewiſe in the ſalt lakes of Siberia; it ſwims on its back, and leaps. It is injurious to fiſhermen by eating their nets, and alſo hurtful to fiſhes, by exciting ulcers on their gills. It ſhines in the dark. **pulex.*

B. *Antennæ two.*

‖ *Two arched Scales in place of the posterior Antennæ.* Scyllari Fabricii.

* *arctus.* The scales of the antennæ fringed with prickles. 75. A native of almost every sea.

‖‖ *Scales none; Antennæ fringed with thickly-set hairs.* Hippæ Fabricii.

cancharus. Thorax wrinkled and oval; claws compressed and prickly along the edges. 72. A native of South America and India.

181 species of this genus have been described by Gmelin, in the last edition of the System of Nature.

117. Monoculus.

Legs formed for swimming; very long; from four to eight. Body covered with a shell, composed of from five to ten segments, growing smaller towards the tail. Antennæ two; those of the male thicker and shorter than those of the female. In some species they are wanting. Sometimes one eye, more frequently two, approaching very near to one another. Feelers four, constantly in motion while the animal is swimming; the posterior pair are very small, and bent like hooks.

The insects of this genus live in water; some of them are found in the sea, others in rivers, but most of them in stagnant waters; they have been called *monoculi* from the circumstance of some of them having but one eye, or two eyes placed so close together as to appear but one. Some of them are viviparous, some oviparous.

A. *Those which have one Eye.*

§ *Body covered with a hard Crust.*

‡ *Antennæ none.* Polyphemus Mulleri.

oculus. Feelers two, long and divided; tail inflected. 10. A native of Europe. To be found in lakes and marshes from May to September. It swims on its back, frequently in large swarms; eye very black, occupying almost the whole of its head.

‡‡ *Antennæ two or four.* Cyclopes Mulleri.

§ *Antennæ four.*

* *quadricornis.* Tail straight, and divided at the extremity. 6. A native of Europe; in fresh waters. Body grayish or greenish, smooth or covered with hair; legs eight and hairy. Female with an oval bag on each side of the tail, which contain the eggs. The antennæ in the male are much thicker and shorter than in the female; the tail is composed of four articulations; in the female it is furnished with two small spines. When viewed in the microscope they are found to have two eyes placed very close together. They are very frequent even in the purest water, and are often swallowed along with it.

†† *Antennæ two.*

§ *Antennæ linear.*

* *rubens.* Reddish; tail straight and forked. 13. A native of Europe; in marshes, lakes, and rivulets: it is to be met with throughout the whole year. The antennæ as long as the body; legs eight.

‖‖ *Antennæ nearly clavated.*

claviger. Antennæ stiff; tail bifid. 18. Inhabits, though rarely, the rivers of Germany; and glides slowly along, alternately on its back, belly, and sides; and sometimes raises itself upright. Upper part of the body white, beneath red; legs eight; tail very small and without articulations.

§ § § *Antennæ dilated.*

crassicornis. Antennæ short; tail furnished with two sharp points. 19. A native of Europe; in marshes. It is very rare. Body composed of five segments; the antennæ swelling from the base to the middle, and becoming sharp towards the extremity.

§ § § § *The tip of the Antennæ terminating in three points.*

curticornis. Antennæ very small and straight; body without articulations; claws smooth; tail furnished with two bristles. 20. Inhabits salt water.

§ § § § § *Antennæ bent backwards.*

chelifer. Antennæ short; body without articulations, furnished with claws; tail furnished with two bristles. 21. Inhabits salt water.

§ § § § § § *Antennæ of the (male) furnished with little hooks.*

brevicornis. The bristles of the tail very short. 22. Inhabits salt marshes. It very much resembles the *M. quadricornis*; the top of the antennæ in the female larger, and forked at the extremity.

†† *Those which have a bivalved Shell.*

‡ *Head exposed; two-branched Antennæ; Legs from eight to twelve.* Daphniæ Mulleri.

§ *Tail bent inwards.*

* *pulex.* The posterior part of the shell set with sharp points. 4. It is found everywhere in stagnant waters, and in great abundance. It is a frequent cause of the water assuming the colour of blood. The shell is yellowish; the abdomen, intestines, and ten legs red. The female is three times the size of the male; and produces from eight to twelve green eggs; the back is marked with a large square spot resembling a saddle.

§ § *Tail bent downwards.*

crystallinus. The shell without prickles; the head furnished with two short projecting horns. 29. A native of the north of Europe; in lakes and rivers. White and oblong; very transparent; viviparous, and furnished with twelve hairy feet.

§ § § *Tail bent backwards.*

pediculus. Tail bent backwards. 5. A native of Europe; in fresh water.

§ § § §

§ § § § Tail ſtraight.

ſetifer. The anterior angles of the ſhell furniſhed with a tuft of briſtles. 30. A native of Europe; in ſtagnant waters; tranſparent, of an oblong oval form; antennæ divided into three, furniſhed with eight or more hairy legs; the extremity of the tail terminating in two hooks.

‡ ‡ Head concealed; Antennæ two and hairy; Legs eight. Cytherææ Mulleri.

viridis. Shell kidney-ſhaped and downy, 31. A native of Europe; found on various ſpecies of *fucus* and *conferva*; the extremity of the antennæ terminating in three points; the fore-legs formed like hooks.

‖ ‖ ‖ Head concealed; Antennæ two, like hairs; Legs four. Cyprides Mulleri.

** conchaceus.* Shell oval and downy. 7. Found in clear ſtagnant waters; the antennæ white or yellowiſh, and ſtretched out; ſwims very ſwiftly, with ten briſtles. It is green, opake; feet yellowiſh; abdomen nearly bilobed and orange-coloured, marked in the middle with a black circle. It conceals itſelf within its ſhell, and ſwims on its belly. It reſembles a muſcle in miniature, is very minute, and ſeldom exceeds the tenth part of an inch.

† † † Thoſe with ſhells conſiſting of one valve.

‡ Legs four; Antennæ two. Amymonæ Mulleri.

**ſatyrus.* Shell oval; antennæ obtuſe, and extended in a vertical direction. 46. It is frequent in clear freſh water; it is agitated at intervals with a tremulous motion; the ſhell is flat and membranaceous; antennæ rigid, furniſhed with three very ſhort briſtles at the extremity; the fore-legs thick and bifid; tail terminating abruptly, eight-cleft in the middle. The inſect is tranſparent.

‖ ‖ Legs ſix; Antennæ two. Nauplii Mulleri.

bracteatus Shell orbicular, and without ſpines or briſtles. 52. It is rare; found in clear freſh water; the ſhell very tranſparent; the antennæ reſembling legs; the legs terminating in three briſtles; the eye not conſpicuous.

B. *Eyes two.* Binoculi.

† Thoſe with ſhells compoſed of one valve.

§ Eyes two placed beneath; Antennæ two; Legs four to eight. Arguli Mulleri.

**delphinus* Legs eight. 55. Found in rivers.

§ § Eyes ſituated on the back; Antennæ two or ſix; Legs varying in number. Limuli Mulleri.

polyphemus. Shell orbicular; future in the middle of the form of a creſcent; tail triangular, long and tapering. 1. A native of the Indian ſeas, particularly in the neighbourhood of the Molucca iſlands. It is likewiſe found on the ſhores of Carolina. It is the largeſt of all known inſects; ſometimes it grows to the length of four feet. It is frequently found in pairs, male and female. It is very rarely found among petrefactions. There are ſeven ſpines on the anterior part of the back of the ſhell: legs 14.

Shell oblong; the future before of the form of a creſcent; tail compoſed of two briſtles. 3. A native of Europe; in ditches, ponds, &c.; and though dried in ſummer, when the water has evaporated, yet they revive when the water returns. This is the largeſt ſpecies to be found in Britain. ** apus.*

§ § § Eyes placed on the ſides; Antennæ two, ſetaceous; Legs eight or ten. Caligi Mulleri.

Body ſhort; tail bifid, and compoſed of one thin flap. 2. A native of the European ſeas. Found on flounders, cod-fiſh, ſalmon, &c. adhering on the outſide between the ſcales; running ſwiftly both on the fiſh and on the water. ** piſcinus.*

† † Thoſe with Shells compoſed of two valves; Head not encloſed within the ſhell; the Eyes placed on the ſides; Antennæ two or four, reſembling hairs, and placed beneath; Legs eight and more. Lynceæ Mulleri.

Tail inflected; ſhell globular. 60. A native of Europe. It is found about the edges of ſtagnant waters, and among duck-weed. It is very minute; the ſhell is reddiſh; antennæ two; legs twelve; tail furniſhed with a ſmall hook at the extremity and concave beneath; the ovaria green. ** ſphæricus.*

66 ſpecies of this genus have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature.

118. Oniscus.

Jaw terminating abruptly, and furniſhed with ſmall teeth. Lip bifid. Feelers unequal, the poſterior ones being longer than the others. Antennæ ſetaceous. Body oval. Legs fourteen.

The ſpecies of this genus feed on the leaves of plants, on filth, and on the juices of animals; ſome of them are very injurious to the fruit of wall-trees; they undergo no other change but a change of ſkin. They are found under ſtones, in old walls, houſes, and woods; ſome ſpecies live in water.

Abdomen covered with two thin plates; the tail ſemioval. 1. A native of the European ſeas. Viviparous; and is very injurious to fiſhes. ** aſilus.*

Antennæ four; tail long and ſharp. 5. Inhabits the ſea. It ſwims very quickly. It lives on crabs and fiſhes; the fiſhermen diſlike it very much. ** entomon.*

Oval, and of a browniſh aſh-colour; tail obtuſe and entire. 15. A native of Europe; under ſtones. When touched it rolls itſelf up into a hard motionleſs ball; from which circumſtance it has received the name of *armadillo*. ** armadillo.*

Oval; tail obtuſe, furniſhed with two ſimple appendages. 14. A native of Europe; in houſes, walls, woods, &c. The young are contained in a follicle of four valves on the abdomen of the mother. This ſpecies was formerly uſed in medicine. ** aſellus.*

38 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

119. Scolopendra.

Antennæ ſetaceous. Feelers two, filiform; articulated and connected within the jaws. Lip divided and marked with ſmall projections. Body flattiſh. Legs very numerous; one on each ſide of each of the ſegments of the body.

Theſe inſects live in decayed wood, about houſes, under ſtones, and ſome of them in freſh water. They feed on other inſects in every ſtage of their exiſtence. The larvæ differ but little from the perfect inſect, except that they have fewer feet. The pupæ likewiſe are active, and very much reſemble the perfect inſect. All the European ſpecies are ſmall, but in tropical countries they are to be ſeen a foot long and an inch and a half in circumference.

* *lagura.* Twelve legs on each ſide; body oval; tail furniſhed with a white tuft of hairs. 1. A native of Europe; in moſſy ground.

* *forficata.* Legs fifteen on each ſide. 3. A native of Europe and America. Very frequent under ſtones.

gigantea. Legs ſeventeen on each ſide. 4. A native of America.

morſitans. Legs twenty on each ſide; eyes eight. 5. A native of America and India. Body compoſed of 22 ſegments; the antennæ conſiſting of 20 articulations. It is much dreaded on account of its bite, which is ſaid to be poiſonous.

* *electrica.* Legs 70 on each ſide; body linear. 8. A native of Europe; in cloſe damp places, and ſhines in the dark.

phoſphorea Legs 76 on each ſide. 9. A native of Aſia. It ſhines in the dark like the *lampyris*; it is ſaid that this inſect has dropt from the air into a ſhip 100 miles from land, in the Indian and Æthiopian ſeas. Head oval, yellowiſh, and marked with two grooved lines, and a third tranſverſe line; body filiform, and is about the thickneſs of a gooſe-quill, marked with two parallel yellow lines; antennæ tapering, of a ruſty colour, and conſiſting of 14 articulations.

12 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

120. Julus.

Antennæ moniliform. Feelers two, filiform and jointed. Body ſemicylindrical. Legs very numerous, two on each ſide of every ſegment of the body.

The inſects of this genus feed on other inſects, particularly *acari*. The larva and pupa have many feet, are active, and reſemble the perfect inſect.

Legs 20 on each ſide. 1. A native of the Eu- *ovalis.*
ropean ſeas.

Legs 134 on each ſide. 9. A native of America. *maximus.*
This is the largeſt ſpecies of the genus. It bites ſeverely, but is not poiſonous.

Legs 120 on each ſide. 5. A native of Europe; * *fabuloſus.*
in ſandy places, and on the hazel.

12 ſpecies of this genus have been deſcribed in the laſt edition of the Syſtem of Nature.

The following table exhibits the number of ſpecies included under each order.

Coleoptera	4087
Hemiptera	1427
Lepidoptera	2570
Neuroptera	174
Hymenoptera	1265
Diptera	692
Aptera	679
In all	10,894

GENERAL OBSERVATIONS.

Though the definition of an inſect which we have already given from Linnæus be perfectly correct, (viz. a ſmall animal breathing through pores on its ſides, furniſhed with many feet and moveable antennæ, covered with either a hard cruſt, or a hairy ſkin), it may not be improper to mention, more at large, thoſe circumſtances which form the line of diſtinction between inſects and other animals.

1. Inſects are not furniſhed with red blood, but inſtead of it their veſſels contain a tranſparent lymph. This may ſerve to diſtinguiſh them from the ſuperior animals, but it is common to them with many of the inferior; though Cuvier has lately demonſtrated the exiſtence of a kind of red blood in ſome of the *vermes*.

2. They are deſtitute of internal bones, but in place of them are furniſhed with a hard external covering to which the muſcles are attached, which ſerves them both for ſkin and bones; they are likewiſe without a ſpine formed of vertebræ, which is found in all the ſuperior claſſes of animals.

3. They are furniſhed with articulated legs, ſix or more; this circumſtance diſtinguiſhes them from all other animals deſtitute of a ſpine formed of vertebræ.

4. A very great number of inſects undergo a metamorphoſis: this takes place in all the winged inſects.

5. They frequently change their ſkin in the progreſs of their growth.

6. A very great number of inſects are furniſhed with jaws placed tranſverſely.

7. The wings, with which a very great number of inſects are furniſhed, diſtinguiſh them from all other animals which are not furniſhed with a ſpine compoſed of vertebræ.

8. Inſects are oviparous; ſcorpions and aphides during the ſummer months are viviparous.

9. Inſects have no noſtrils.

10. Inſects are deſtitute of voice.

11. They are not furniſhed with a diſtinct heart compoſed of ventricle and auricle.

12. Incubation is not neceſſary for hatching their eggs.

The Organization of Inſects.

When we wiſh to become throughly acquainted with natural objects, we muſt not confine ourſelves to an examination of their external appearance and configuration,

General Observations.

guration, but ought to examine their internal ſtructure and their component parts; and extend our inquiries to every thing which relates to them. Inſects, like all other organized bodies which form the animal and vegetable kingdoms, are compoſed of fluids and ſolids.

In the four ſuperior claſſes of animals. viz. quadrupeds, birds, reptiles, and fiſhes, the bones form the moſt ſolid part, and occupy the interior part both of the trunk and limbs; they are ſurrounded with muſcles, ligaments, cellular membrane, and ſkin. The matter is entirely reverſed in the claſs of inſects; the exterior part is moſt ſolid, ſerving at the ſame time both for ſkin and bones; it encloſes the muſcles and internal organs, gives firmneſs to the whole body, and by means of its articulations, the limbs, and different parts of the body, perform their various motions. In many inſects, ſuch as the crab, lobſter, &c. the external covering is very hard, and deſtitute of organization; it is compoſed of a calcareous phoſphate, mixed with a ſmall quantity of gelatine, formed by an exſudation from the ſurface of the body. As its great hardneſs would check the growth of the animal, nature has provided a remedy; all of theſe cruſtaceous inſects caſt their ſhell annually. The ſkin of moſt of the other inſects, though compoſed likewiſe of calcareous phoſphate, is ſofter and organized, being formed of a number of thin membranes adhering cloſely to one another, and putting on the appearance of horn. It owes its greater ſoftneſs to a larger proportion of gelatine. The muſcles of inſects conſiſt of fibres formed of faſciculi; there are commonly but two muſcles to produce motion in any of their limbs, the one an extenſor, the other a flexor. Theſe muſcles are commonly attached to a tendon compoſed of a horny ſubſtance, connected to the part which they are deſtined to put in motion. The articulations of inſects are formed in a variety of ways; Cuvier, in his Comparative Anatomy, tom. i. page 445, has given a very minute account of them. Though Linnæus, and ſeveral others following him, have aſſerted that inſects have no brain, yet it is certain that at leaſt a number of the larger kind, as the lobſter, crab, &c. have a ſoft ſubſtance ſimilar to brain, from which the optic and other nerves take their riſe; beſides, when this ſubſtance is irritated, the animal is thrown into convulſions; hence we would conclude, that inſects have a brain as well as the animals of the four ſuperior claſſes, though it be ſmaller in proportion to their body.

In moſt inſects the brain is ſituated a little above the œſophagus; it divides into two large branches which ſurround the œſophagus, and unite again under it, from which junction a whitiſh nervous cord proceeds, correſponding to the ſpinal marrow of the ſuperior animals, which extends the whole length of the body, forming in its courſe twelve or thirteen knots or ganglions, from each of which ſmall nerves proceed to different parts of the body. Thoſe who deny that inſects have no brain, lay much ſtreſs on this circumſtance, that many inſects are capable of running about after they have been deprived of their heads; the *hippoboſca* in particular, is frequently inſtanced, which moves about quite readily, and is even ſaid to copulate after its head has been cut off. The ganglions which are formed in the courſe of the larger nerves, perform in a great meaſure the function of the brain, indeed each of theſe ganglions may be viewed as a ſubordinate brain; in this way it may be eaſily conceived how the various parts which derive their nerves from any one of theſe ganglions, may be enabled to perform their different functions, after they have been ſeparated from the other parts of the body, and deprived of all connexion with the brain.

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Whether inſects be endowed with any ſenſes different from thoſe of the ſuperior animals, cannot eaſily be aſcertained, becauſe we are only acquainted with the five which we ourſelves enjoy. It appears pretty evident that they poſſeſs viſion, hearing, ſmell, and touch; as to the ſenſe of taſte we are left to conjecture, for we are acquainted with no facts, by which we can prove that inſects enjoy the ſenſe of taſte, nor do we know of any by which we can prove that they do not.

The eyes of inſects are of two kinds; the one compound, compoſed of a number of lenſes, large, and only two in number; the other are ſmall, ſmooth, and vary in number from two to eight. The ſmall lenſes which form the compound eyes are very numerous; they amount in ſome inſects to many hundreds. Leeuwenhoek has counted 800 of them in the eye of a fly. Pugett ſays he obſerved upwards of 17,000 in the eye of a butterfly. The eyes of inſects are without eyelids, and are covered externally with a hard ſmooth ſubſtance. Cuvier has given the anatomy of the eye of a dragon-fly. The internal ſurface of the lenſes is covered with a black varniſh. Under each of the lenſes of which the eye is compoſed, there is a ſmall nervous fibre, attached to the edge of the black covering which lines the internal ſurface of each lens by one extremity, and by the other to a membrane which is of the ſame extent with the cornea, which Cuvier calls the *choroide*. It is eaſily detached from the ſmall nervous fibre, and appears to the naked eye, finely radiated with black and white; behind this there is ſtill another membrane compoſed entirely of medullary ſubſtance, which is connected on each ſide with the hemiſphere of the brain.

Whether inſects from the compound nature of their eyes ſee objects multiplied, or enjoy only ſingle viſion, cannot be aſcertained; were objects to be ſeen multiplied in proportion to the vaſt number of lenſes of which the eyes of inſects are compoſed, viſion would certainly be very confuſed, and were we to be guided by analogy; we might naturally enough ſuppoſe that inſects ſaw objects ſingle with their compound eyes, as we ourſelves ſee objects ſingle with two eyes.

The eyes of inſects, according to Swammerdam, do not contain the ſame humours which are found in the eyes of animals which compoſe the ſuperior claſſes. The external membrane which covers the eyes, varies in colour in different inſects; in many of the dipterous inſects, particularly the gad-fly, it is agreeably variegated.

The far greater number of inſects have only two eyes, like the animals of the ſuperior claſſes; ſome have three, e. gr. the *ſcolopendra;* ſome four, e. gr. *gyrinus;* ſome ſix, e. gr. *ſcorpions;* ſome eight, e. gr. *ſpiders*.

The eyes of inſects are commonly immoveable; crabs, however, have the power of moving their eyes.

That inſects are endowed with the ſenſe of hearing can no longer be diſputed, ſince *frog-hoppers, crickets,* &c. furniſh us with undeniable proofs of the fact. Nature has provided the males of theſe inſects with the means of calling their females, by an inſtrument fitted to produce a ſound, which is heard by the latter. The

male

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male and female *death-watch* give notice of each others preſence, by repeatedly ſtriking with their mandibles againſt old wood in houſes, or decayed trees, their favourite haunts. Their ears have been diſcovered to be placed at the root of their antennæ, and can be diſtinctly ſeen in ſome of the larger kinds, as the lobſter.

That inſects enjoy the faculty of ſmelling, is very evident. It is the moſt perfect of all their ſenſes. *Beetles* of various ſorts, *nitidulæ*, the different ſpecies of *dermeſtes*, *ſylphs*, *flies*, &c. perceive at a very conſiderable diſtance, the finell of ordure and dead bodies, and reſort in ſwarms to the ſituations in which they occur, either for the purpoſe of procuring food or laying their eggs. The common blue fleſh-fly, is attracted by the ſtrong ſmell of the *arum dracuntium*, which very much reſembles that of carrion, and depoſits its eggs on it: theſe flies are likewiſe deceived, and depoſit their eggs on the flowers of the *ſtapelia hirſuta*, which has a very cadaverous ſmell. But, though we can thus eaſily prove the ſenſe of ſmell among inſects, it is difficult to diſcover the ſeat of that particular ſenſe. Several naturaliſts have ſuppoſed that it reſides in the antennæ. Dumeril, in a diſſertation publiſhed in 1799, attempts to prove, that it muſt be ſituated about the entrance of the ſpiracula or reſpiratory organs, as Baſter had previouſly ſuppoſed. Notwithſtanding his arguments, Latreille is ſtill diſpoſed to follow the opinion of thoſe who believe the antennæ to be the organs of ſmell. His reaſons for favouring this opinion are:

1. Smell is produced by the action of air, impregnated with odoriferous particles, on the nervous or olfactory membrane, which tranſmits the ſenſation.

If inſects be endowed with an organ, furniſhed with ſimilar nerves, capable of receiving impreſſions from air charged with odoriferous particles, ſuch organ may be regarded as that of ſmell. Should the antennæ preſent a tiſſue of many nerves, what inconvenience can reſult from ſuppoſing that this tiſſue is capable of tranſmitting odour? Would not this hypotheſis, on the contrary, be more ſimple, and more conſonant to anatomical principles, than that which fixes the ſeat of ſmell at the entrance of the ſpiracula?

2. Many male inſects have their antennæ more developed than the females; a fact eaſily explained, if we admit that theſe organs are the ſeat of ſmell.

3. It is certain that moſt of thoſe inſects which live or depoſit their eggs on putrid animal or vegetable matters, ſtagnant waters, &c. are almoſt uniformly diſtinguiſhed by a greater developement of the antennæ; ſuch, for example, as the beetle, ſylphs, leather-eaters, tipulæ, &c. Theſe required a more perfect ſenſe of ſmell, and are organized accordingly.

4. A great many inſects, which are entirely rapacious, have ſimple antennæ; and thoſe which are characteriſed by ſimilar manners, and which are ſedentary, have none at all; as for inſtance ſome of the ſpiders.

5. Inſects diſcover their habitations and food by the ſenſe of ſmell. Latreille deprived ſeveral inſects of their antennæ, and found they inſtantly fell into a ſtate of ſtupor or derangement, and ſeemed to be incapable of recogniſing their haunts or their food, though placed cloſe by them. Such experiments deſerve to be proſecuted. With this view, were the antennæ of dung-beetles to be coated with varniſh, and the animals placed near excrement, (their uſual food), a deciſive proof would be obtained; for were they readily to find their way to the excrement, it may be fairly inferred that the antennæ were not the organs of ſmell. Should the reverſe take place, an oppoſite concluſion might naturally be drawn. General Obſervations.

6. Nerves terminate the antennæ, the articulations of which, though externally covered with a pretty thick membrane, are hollow, lined within with a ſoft ſubſtance, which is often of a watery conſiſtence, the extremities of which, when expoſed to the air, may receive impreſſions from it.

Some have imagined the antennæ to be the organs of touch; but Latreille contends that ſuch an opinion is by no means ſupported by facts, and alleges that the ſhortneſs of the antennæ in moſt ſpecies, and the way in which moſt inſects carry their antennæ, ſeem to prove the contrary. He thinks their antennæ ill adapted to become the organs of touch, becauſe they have a hard and ſcaly covering. He is rather inclined to believe that the ſenſe of touch, at leaſt in certain ſpecies, is ſituated in the paws or extremities of the fore legs. The palpi or feelers in ſpiders and ſome other inſects, ſeem to poſſeſs the ſenſe of touch in an eminent degree; but many are diſpoſed to conſider theſe palpi rather as the organs of taſte. Though we have no direct proof that inſects enjoy the ſenſe of taſte, yet we may naturally enough ſuppoſe that they do, both from analogy, and from the circumſtance that moſt inſects prefer ſome particular kinds of food to all others; many of them will rather die of famine, than eat any other kind of food than that which is peculiar to them. The ſuperior part of the œſophagus has been ſuppoſed by ſome to be the ſeat of the organ of taſte.

Aliment of Inſects.

Insects feed on a great variety of ſubſtances; there are few things either in the vegetable or animal kingdoms which are not conſumed by one or other of them. The leaves, flowers, fruit, and even the ligneous parts of vegetables, afford nouriſhment to a very numerous claſs; animal bodies both dead and alive, even man himſelf, is preyed on by many of them; ſeveral ſpecies of the louſe, of acarus, of the gnat, and the common flea, draw their nouriſhment from the ſurface of his body; the *gigur* or *chiegoe*, (*pulex ulcerans*), penetrates the cuticle, and even enters his fleſh. A ſpecies of gad-fly (*œſtrus hominis*) depoſits its eggs under his ſkin, where the larvæ feed; the *phalena pinguinalis* frequently finds its way into his ſtomach, where it ſometimes proves a fatal lodger. Other caterpillars inſinuate themſelves into different cavities of his body. All the inferior animals have their peculiar paraſitical inſects which feed on them during their life.

There are ſome inſects which can feed only on one ſpecies. The caterpillars both of moths and butterflies, which feed on the leaves of ſome particular vegetable, would die without being able to taſte any other. There are others which can make uſe of two or three kinds of vegetables, but which never attain full perfection, except when they are fed on one particular kind; for example, the common ſilk-worm, which eats readily all the ſpecies of mulberry, and even common lettuce, neither attains ſo great a ſize, nor produces ſo much ſilk, as when fed on the white mulberry. Although that ſpecies of coc-

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cus which produces the lac, feeds on the *ficus religiosa*, *ficus indica*, *rhamnus jujuba*, and *plosa* Horti Malabarici; yet the lac collected from the *ficus religiosa*, is very much superior in quality. That species of coccus which produces the cochineal, if it will at all feed on any other species of vegetables, never affords a dye equal to that which is to be obtained from it when fed on that particular species of cactus called *coccinellifera* by Linnæus. There are a great many which feed indiscriminately on a variety of vegetables, which from that circumstance receive the title of *polyphaga*. Almost all herbivorous insects eat a great deal, and very frequently; and most of them perish if deprived of food, for but a short time. Carnivorous insects can live a long while without food, *e. g.* the *carabus*, *dytiscus*, *cicindela*, spiders, &c. As many insects cannot transport themselves easily in quest of food, to places at a distance from one another, nature has furnished the perfect insects of many species with an instinct, which leads them to deposit their eggs in situations where the larvæ as soon as hatched, may find that kind of food which is best adapted to their nature.

Most of the butterflies, though they flutter about and collect the nectarious juice of a variety of flowers as food for themselves, always deposit their eggs on, or near to those vegetables destined by nature to become the food of their larvæ. The various species of *ichneumon* deposit their eggs on the bodies of those insects on which their larvæ feed. The *sirex* (tailed wasp), and *sphex* are likewise careful to deposit their eggs in situations where their larvæ, when hatched, may find subsistence. The *ichneumon seductor*, after having killed an insect (most commonly a spider) deposits an egg on it, and then shuts it up in a cell which it forms of clay. The *sphex figulus* likewise deposits its eggs on the body of spiders which it has killed, and encloses it in a cell composed of clay. Some insects, at different periods of their existence, make use of aliment of very different properties: the larvæ of some are carnivorous, while the perfect insect feeds on the nectarious juice of flowers: e. g. *sirex*, *ichneumon*, &c. The larvæ of most of the lepidopterous insects feed on the leaves and young shoots of vegetables, while the perfect insects either take no food at all, or subsist on the sweet juice which they extract from flowers: indeed the construction of their mouths prevents them from taking any other than fluid food.

The alimentary organs may be divided into four parts. 1. Those of Mastication; 2. Deglutition; 3. Digestion; and 4. Excretion. The organs of mastication vary considerably in different insects. Amongst those animals, some subsist on solid food; therefore must be furnished with tentacula (or pincers) for its comminution. Others subsist on liquid food, and are furnished with suckers, which vary in form in different insects. Sometimes with a trunk formed of a double sheath twisted in a spiral form, as is to be seen in the butterfly and the sphinx. Sometimes with a sharp stiff beak bent towards the breast; such as in the bug, the frog-hopper, and boat-fly. At other times with a fleshy proboscis ending in two moveable lips, or in a sucker composed of several syphons, incloſed in a sheath consisting of two valves, which is the case in the dipterous insects; such as the common fly, the horse fly, the gnat, &c.

Amongst insects which have jaws, some, such as those of the orders *Coleoptera* and *Aptera*, have these parts hard and composed of a horny substance, and subsist on matters of a considerable degree of tenacity. Those coleopterous insects which have six feelers feed on living insects; and those which have only four, feed on putrid animal or vegetable substances. The other insects furnished with jaws (such as many of the order *Hymenoptera*), have these parts soft and membranaceous, and consequently subsist on liquid or very succulent food.

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There are no salivary glands to be met with in the mouths of insects, but a set of floating vessels secrete a fluid, varying in colour in different insects, very similar to saliva.

The organs of deglutition present nothing very remarkable. The œsophagus is a straight short tube, reaching from a little way under the brain to the first ganglion of the nerves, which perhaps may be considered as the cerebellum of insects. In the insects without jaws, deglutition is performed by a tube composed of annular muscular fibres. The trunk of the butterfly, the proboscis of the common fly, and the beak of hemipterous insects, may be considered as part of the œsophagus projecting beyond the mouth.

The organs of digestion consist of the stomach and intestinal canal. The stomach of insects varies very much according to the nature of the aliment on which they subsist. Sometimes it is single, frequently double, at other times manyfold. The greater number of insects have a single stomach, which is sometimes entirely membranaceous, sometimes muscular, and at other times it is merely the continuation of the œsophagus without any perceptible dilatation. Those insects which have a dilated membranaceous stomach, subsist commonly on the juices of vegetables; such as the bees, which suck the nectar of flowers, the butterflies &c. Their stomachs are almost always dilated, owing to the disengagement of gas from the substances they contain. Those which are furnished with a muscular stomach, such as the bug, the boat-fly, and almost all the hemipterous insects, feed on animal substances. Finally, these which have no dilatation in the œsophagus so as to form an evident stomach, commonly feed on the leaves and roots of vegetables, such as the cock-chaffer and all the beetles. The whole of the alimentary canal in these insects is very long, without any perceptible enlargement. The double stomach is to be found in those coleopterous insects which feed on other live insects, such as the *cicindela*, *carabus*, *attelabus*, &c. all of them are likewise distinguished by six palpæ. The first of their two stomachs is muscular, and is a sort of gizzard, the muscles of which are composed of slender fibres. The second is a long membranaceous canal, which appears villous when examined by the microscope; this villosity at first sight may appear singular, but a little attention to the manner in which nutrition goes on in insects, will suggest an explanation of this peculiarity. When we consider that circulation proceeds very slowly, and that the nutritive fluids must be nearly in a state of stagnation, digestion could not proceed without the assistance of absorbent tubes, which may take up these fluids. We may naturally enough suppose this villosity to be nothing else, but a number of absorbent vessels which take up the nutritive part of the circumambient fluid. Those insects which have many stomachs may be called ruminating, because they have

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have the power of cauſing the food to return from the ſtomach to be chewed over again; ſuch as the graſshopper, cricket, &c.

The mole cricket has a long œſophagus terminating in a round membranaceous ſtomach, which may perhaps be compared to the firſt ſtomach of the ruminating animals of the claſs *Mammalia*; where the food is accumulated, to be thrown back into the mouth, again to undergo a farther maſtication.

A ſhort inteſtine proceeds from this into a ſecond ſtomach much leſs than the former, but muſcular and apparently thicker, and furniſhed with parts which reſemble the grinders in the ſtomach of crabs. They are ſmall laminæ, reſembling ſaws, diſpoſed in five longitudinal rows, each compoſed of from ten to twelve ſmaller laminæ, which perform a ſort of periſtaltic motion by means of the muſcular action of the ſtomach; and it appears pretty evident that the action of thoſe laminæ is exerted on the food contained in the ſtomach. The other two ſtomachs are very ſimilar, and placed one oppoſite to the other at the opening of the inteſtine which correſponds to the duodenum of the ſuperior animals; they are wrinkled and thicker than the firſt ſtomach, but not ſo thick as the ſecond.

This apparatus is to imbibe ſome part of the fluid from the aliment.

In the graſshopper the ſtomachs are ſimilarly arranged. The cricket has to the number of five ſmall and ſlender ſtomachs; indeed the two firſt ſeem only to be ſimple dilatations of the œſophagus.

In the cock-roach there is only one ſtomach which is very large, and almoſt entirely membranaceous; at the extremity of which, there is a number of partial enlargements which may be conſidered as ſo many ſtomachs. The ſtomachs of the larvæ frequently differ from thoſe of their perfect inſects; viz. the alimentary canal of the caterpillar differs very much from that of the butterfly; and the inteſtinal canal of the grub differs widely from that of the beetle.

The œſophagus of the grub of the *ſcarabæus naſicornis* dilates ſuddenly, forming a cylindrical ſtomach which is furniſhed with three ranges of cœcum, which have their extremities ſimple and looſe. The inteſtine proceeds in a ſtraight line from the ſtomach; then having formed a doubling, becomes larger, and puts on the appearance of a colon, four times the length of the ſtomach; on which is to be perceived two tendinous lines. At the extremity of the colon there is a conſiderable dilatation; beyond which it becomes ſlender, and forms the rectum. The inteſtinal canal of the *ſcarabæus melolontha*, or cock-chaffer, is almoſt exactly ſimilar; but nothing analogous to this ſtructure is obſervable in the perfect inſect. The inteſtines of the *ſcarabæus melolontha*, and *ſc. naſicornis* are very long, very much contorted, and equal throughout their whole length.

The larva of the *hyarophilus* has a very evident ſtomach, and a very ſhort inteſtine. In the perfect inſect the inteſtine is long, without any viſible enlargement or ſtomach, which may be accounted for, perhaps in this way; the larvæ ſubſiſt on animal food, while the perfect inſects feed on vegetables. The examples we have juſt given are ſtriking. It may be remarked, that whenever the larvæ and the perfect inſect ſubſiſt on the ſame kind of food, the difference in ſtructure is leſs remarkable; only the inteſtinal canal is longer in the perfect inſect.

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The anus or the poſterior orifice of the inteſtinal canal, not only affords a paſſage for the excrement, but encloſes the extremities of the parts of generation. There are neither kidneys, bladder of urine, pancreas, nor any of the conglomerated glands obſervable in animals of the ſuperior claſſes, to be found in inſects.

Inſtead of the liver, there is a number of ſmall floating filaments which ſurround the inteſtinal canal for almoſt two thirds of its length. There is a great quantity of fat in many inſects, particularly in thoſe which ſpend a conſiderable portion of their lives in a torpid ſtate. It is contained in looſe membranes that fill up the intervals between the bronchiæ. This fat in caterpillars is very white, and both in taſte and conſiſtence very much reſembles that of other animals. The quantity is ſo conſiderable in ſome inſects as to equal one third of the bulk of the body. All the inſects which undergo a metamorphoſis, are abundantly ſupplied with this fat; without it, indeed they ſeem unable to go through their deſtined changes; for it has been obſerved, that thoſe caterpillars which have been fed on by the larvæ of the various ſpecies of ichneumon, though they may ſurvive the ravages of theſe paraſitical inſects till they are changed into pupæ, commonly die before they become perfect inſects.

The Reſpiration of Inſects.

Respiration is the act of inhaling and exhaling the air into, and out of the lungs. Quadrupeds, birds, and moſt of the amphibia, breathe through the mouth and noſtrils. The air when received into the lungs is mixed with the blood, and imparts to it ſomething neceſſary, and carries off ſomething noxious.

Some authors have aſſerted that inſects have no lungs. But late experiments and obſervations ſhow, that no ſpecies wants them, or at leaſt ſomething ſimilar to them; and in many inſects they are larger in proportion to their bodies than in other animals. In moſt of them they lie at or near to the ſurface of the body, and ſend out lateral pores or tracheæ. The reſpiration of inſects has attracted the attention of many naturaliſts, particularly, Swammerdam, Malpighi, Reaumur, Lyonnet, Muſſchenbroeck, Degeer, Bonnet, Vauquelin, &c.

From their obſervations it may be inferred,

1. That inſects do not breathe through the mouth or noſtrils.

2. That there are a number of veſſels for the reception of air placed along on each ſide of the body, which are commonly called *ſpiracula*, which are ſubdivided into a number of ſmaller veſſels or bronchiæ.

3. That the veſſels or tracheæ which proceed from the pores on the ſides, are not compoſed of a ſimple membrane, but are tubes formed of circular rugæ.

4. That the ſpiracula are diſtinguiſhable, and are covered with a ſmall ſcaly plate, with an opening in the middle like a button hole, which is furniſhed with membranes, or threads, to prevent the admiſſion of extraneous bodies.

Reaumur is of opinion that the air enters by the ſpiracula into the tracheæ and bronchiæ; and is expired through ſmall pores on the ſkin, without returning by the ſame way through which it entered. Were this

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this the caſe, the reſpiration of inſects would differ from that of other animals. Degeer ſeems to entertain the ſame opinion with Reaumur, from the account he has given of the manner in which caterpillars breathe; but thinks that inſpiration and expiration through the ſpiracula and bronchia take place in the pupa. Lyonnet is not of the ſame opinion with Degeer, on account of an experiment made on the pupa of the ſphinx. He ſuppoſes that this pupa lives for a certain time without reſpiration, and that the two anterior ſpiracula, which are the largeſt, and encloſe the poſterior ones, only ſerve the purpoſe of allowing the ſuperabundant moiſture to exhale, and to permit the external air to enter in its ſtead. Some experiments of Muſſchenbroeck ſeem to confirm the opinion of Lyonnet with regard to the pupa.

Perhaps nature, with that foreſight which is obſervable in all her works, has taken care to form the pupa ſo as to require but a ſmall quantity of air, and may have included in its body every thing neceſſary to enable it to undergo the change of its condition. The pupa of moſt inſects is certainly very torpid, and little capable of receiving external impreſſions. The experiments of Malpighi and Reaumur have eſtabliſhed the fact that inſects muſt reſpire. Oil applied to the ſpiracula cauſes theſe animals to fall into convulſions, induces a general or partial paralyſis, or cauſes their death.

Vauquelin, the celebrated chemiſt, has made ſeveral experiments on the reſpiration of the green graſhopper. The male of this inſect being put into ſix cubic inches of oxygen gas (the purity of which was aſcertained), lived eighteen hours. The oxygen gas was changed into carbonic acid gas; it rendered lime water turbid, but did not extinguiſh a lighted candle; after the carbonic acid had been abſorbed by means of fixed alkali, the combuſtion of the candle was more vivid than in common air. He found that the inſect reſpired fifty or ſixty times in a minute; but when put into oxygen, its reſpiration became about twelve times more frequent, being interrupted at laſt almoſt continually, becauſe it was on the point of undergoing aſphyxia. The air in which the inſect had died, being waſhed with alkali, underwent a diminution of five per cent, and the vapour of ammonia could not again revive the inſect.

A female inſect being put into eighteen cubic inches of common air, lived thirty-ſix hours; its reſpiration was not altered as to frequency; the bulk of the air was not diminiſhed at the death of the animal, but it extinguiſhed a candle even after it had been waſhed in lime water; this is a new proof that oxygen is neceſſary to the life of inſects; and when the atmoſpheric air contains but little of it, that inſects would ſoon die.

This female graſhopper, being placed in ſulphurated hydrogen gas, was ſeized with aſphyxia inſtantly, and could be revived by no ſtimulus. Theſe experiments not only prove that inſects reſpire, and that oxygen is that part of the air which is neceſſary to their exiſtence, but that carbonic acid or azote is fatal to them. The ſpiracula are neither of the ſame form, nor ſimilarly ſituated in every inſect; the larvæ of the common fly have ſeveral of theſe organs placed at the poſterior extremity of their bodies; they are moſt frequently ſix.

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Circulation and Secretion of Inſects.

All the animals of the two firſt claſſes have a double circulation; their hearts conſiſt of two diſtinct auricles and ventricles. The heart in the amphibia has two diſtinct auricles without any communication; and under theſe there is the appearance of two ventricles ſimilar in ſhape to thoſe of the former claſs; but they may be conſidered as one cavity; for the ventricle ſends out not only the pulmonary artery, but likewiſe the aorta; for there is a paſſage in the ſeptum, by which the ventricles communicate freely, allowing the blood to paſs from the left into the right one.

The heart of fiſhes has but one auricle and one ventricle, and one great artery which conveys the blood to the gills. The circulation in inſects differs conſiderably from that of the ſuperior animals. In the lobſter, and others of the larger inſects, when a piece of the ſhell is broken, the pulſation of the heart is ſeen diſtinctly, and that ſometimes for ſeveral hours after it has been laid bare. A long delicate veſſel runs along the back parallel to the inteſtines of many inſects, particularly caterpillars, in which an alternate contraction and dilatation is perceptible. The heart, or principal artery which performs the function of the heart, ſeems to be compoſed of a great number of ſmall hearts, connected together, which tranſmit the blood from one to another. But when this veſſel is injected it becomes continuous, and the ſmall hearts diſappear. In the caterpillar the pulſation begins at the poſterior part, and proceeds from one ſegment to another, till it arrive at the head. Reaumur has alleged, that the pulſation of this artery changes its direction in the pupa, and that the blood is propelled from the head towards the tail: he ſays this may be plainly obſerved in a pupa newly ſtripped.

Lyonnet denies the accuracy of Reaumur's obſervations; and ſays that he found a ſpecies of caterpillar, the pupa of which is very tranſparent, in which the longitudinal artery was to be ſeen very diſtinctly; having examined it carefully, a few days after its change, he aſcertained that the motion of the artery had not at all changed its direction, and that it ſtill continued to move from the tail towards the head as in the caterpillar. Further obſervations can alone determine which of theſe two opinions is the moſt correct. One anatomiſt has lately aſſerted that the dorſal canal obſervable in inſects, ſerves the purpoſe of reſpiration. Cuvier has proved, that the conglomerate glands which are to be met with in all the animals that have a heart, do not exiſt in inſects; but inſtead of them, that they are furniſhed with very long ſlender veſſels which float in the internal cavities of the body, without being even connected into faſciculi; from this circumſtance Cuvier is diſpoſed to believe that inſects have no heart. It is by means of theſe fine tubes that the different fluids are ſecreted, which are peculiar to various kinds of inſects. Some inſects diſcharge an acrid and fetid fluid, others diſcharge an oil of a very pleaſant ſmell.

The bee, the waſp, the ſphex, the cryſis, have two veſſels ſituated at the bottom of their ſting, which contain a very acrid fluid, ſecreted from the maſs of blood, which the animal diſcharges at pleaſure through a perforation in the ſting; it is this fluid which cauſes the

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pain, inflammation, and ſwelling, which follow a wound inflicted by theſe inſects.

In the ſcorpion, there is a fluid of a very malignant nature, which the animal diſcharges at pleaſure through its ſting; under certain circumſtances, this fluid produces fatal effects. Some of the ſpiders diſcharge a fluid, which renders their bite dangerous. The *aranea avicularia*, and the *tarantula*, in particular, are well known; even the common ſpiders inflict a fatal wound on the inſects they entangle in their web. The ſilk of the common ſilk-worm and other caterpillars, according to Malpighi, Lyonnet, and others, is a fluid contained in two veſſels, which are of a conſiderable ſize at the extremity, and taper towards the mouth, and become very ſlender.

The *carabus* and *dytiſcus* contain an acid which reddens the infuſion of litmus. The ant contains an acid well known to chemiſts.

The acrid matter contained in the body of the *lytta veſicatoria*, is uſed in medicine, and forms the beſt epiſpaſtic we are acquainted with.

Generation of Inſects.

Inſects are the only animals without vertebræ in which the ſexes are diſtinguiſhed. Copulation is performed in them by the introduction of the parts of generation of the male into thoſe of the female.

All inſects are either male or female, except in a few of the genera of the order *Hymenoptera*, (ſuch as the bee, ant, &c.) where individuals are to be found, which are neither male nor female; and, on that account called *neuters*. Among the bees, the neuters form the far greater part of the community, and perform the office of labourers. Among the ants, the neuters are very numerous, and conſtitute the only active members of the ſociety. It has been alleged that theſe neuters are nothing but females, whoſe parts have not been developed for want of proper nouriſhment. Olivier, however, after ſtrict examination, is diſpoſed to think them really different, though he does not adduce facts ſufficient to eſtabliſh his opinion.

The parts which diſtinguiſh the male from the female, may be divided into two claſſes, viz. 1. Thoſe which are not directly connected with generation. 2. Thoſe which are abſolutely neceſſary for the purpoſes of generation. The circumſtances which have no direct communication with generation, which ſerve to point out the diſtinction between the ſexes, are, 1. The difference of ſize, obſervable in the male and female. 2. The brightneſs of the colour in each. 3. The form and number of articulations of the antennæ. 4. The ſize and form of their wings. 5. The preſence or abſence of a ſting. The male is always ſmaller than the female. The female ant is nearly ſix times larger than the male. The female cochineal is from 12 to 15 times the ſize of the male. The female *termes* is 200 or 300 times the ſize of the male. The colours of the male are commonly much more brilliant than thoſe of the female; this is particularly the caſe in lepidopterous inſects. In ſome inſects, the colour of the male is totally different from that of the female. The antennæ of the male are commonly of a different form, and larger than thoſe of the female. Frequently the males are furniſhed with wings, while the females have none; the *lampyris*, *coccus*, and *blatta*, and ſeveral moths, afford an example of this. The female bee is furniſhed with a ſting, while the male is deſtitute of one. The males of ſome inſects are furniſhed with ſharp prominent points, reſembling horns, ſituated either on the head or breaſt, which are either not perceptible, or very faintly marked in the female. The parts eſſential to generation afford the beſt diſtinguiſhing mark. In moſt inſects they are ſituated near the extremity of the rectum. By preſſing the abdomen near to the anus they may frequently be made to protrude. But the parts of generation are not always ſituated near the anus. In the ſpiders they are ſituated in the feelers. In the *libellula*, the male organ is ſituated in the breaſt, while that of the female is placed at the anus.

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Organs of Generation.

In male inſects, the organs which ſerve for the preparation of the ſemen, bear ſome reſemblance to thoſe organs in the animals which compoſe the claſs *Mammalia*. All of them have four organs, two of which may be compared to the teſticles, and the other two to the *veſiculæ ſeminales*. They vary very much in form in different ſpecies. During the period the male is uſually employed in impregnating the female, theſe parts are very diſtinct; after that, they diſappear totally. In the larger aquatic inſects, (particularly in the *hydrophilus*) beſides theſe four organs already mentioned, there are other two ſmall veſicles which may be compared to the proſtate gland of the ſuperior animals. The *vaſa deferentia* in the *hydrophilus* are ſomewhat reflected, its teſticles are very large, and terminate in a very ſlender folded filament. In the graſhopper, theſe four organs are likewiſe found, but the *veſiculæ ſeminales* are of a compound nature; the teſticles have a good deal the appearance of thoſe of the *mammalia*.

They are of an oval form, and are fixed to the inſide of the back, their convex ſurface is covered with ſeveral tubes of a bright golden colour. After theſe yellow tubes have been removed, the teſticles are eaſily unfolded; like all the other ſecretory organs of inſects, they ſeem to be nothing but a collection of convoluted veſſels. The *veſiculæ ſeminales*, which are attached to the teſticles, are formed into cluſters. In the ſeaſon of copulation, they increaſe in bulk ſo much as nearly to occupy three-fourths of the abdomen; they are full of a limpid fluid, which is the ſemen.

The *vaſa deferentia*, which in moſt inſects are very ſhort, in the *blatta mucronata* are of a conſiderable length, and form ſeveral convolutions before they arrive at the penis.

The *penis*, in inſects, is either ſingle or double. Thoſe which have a ſingle penis, have it placed at the poſterior extremity of the abdomen; in the *libellula*, however, it is placed at the anterior part: it is membranaceous externally; internally it is compoſed of a ſubſtance analogous to the *corpus cavernoſum* of other animals; its form is either cylindrical or conical; it is furniſhed with two ſcales, one on each ſide, which form a ſort of wedge; this wedge being introduced into the vagina of the female, and the ſcales being ſeparated by means of particular muſcles, which are ſituated at their baſe, open the vagina, and make way for the introduction of the penis.

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penis. This ſingular conſtruction is perhaps owing to the want of a proper erection.

Inſects which have a double penis (ſuch as the ſpider) have this organ placed at the extremity of the feelers of the lower jaw; theſe feelers are large in the male. During copulation, they are introduced into two vaginæ ſituated in the anterior part of the abdomen of the female. In theſe inſects, the two ſmall ſcales are likewiſe to be found, which ſerve to open the vagina of the female.

The female is furniſhed with two *ovaria*; they are long tubular canals, in which the eggs are arranged like a ſtring of beads. The eggs which are ſituated next the opening into the oviduct, are largeſt, and they diminiſh gradually as they recede from it, till they diſappear altogether. The tubular canals unite, and terminate in a common canal, which communicates with an oblong cavity, analogous to the uterus. It is in this cavity, that the ſemen of the male is depoſited. Malpighi aſſerts, that the fluid penetrates into the oviduct, by means of a canal of communication, and that the eggs are fecundated the inſtant they paſs the mouth of this canal, as they proceed towards the external orifice of the uterus.

In viviparous inſects, ſuch as the *hippoboſca*, ſcorpion, &c. the ovaria are different. Sometimes the little animals are arranged in cluſters; at other times they compoſe a ſpiral cord, the length of which correſponds to the number and ſize of the fœtus.

Copulation is not performed exactly in the ſame way by all inſects. In moſt of the ſpecies, the male mounts on the back of the female; but the ſpiders, dragon-flies, and ſome others, have a mode of performing copulation peculiar to themſelves. After copulation, they ſoon begin to lay their eggs. Some depoſit their eggs gradually, one after another; others diſcharge them all at once, for example, the *ephemera*, the very ſhort duration of whoſe exiſtence renders this neceſſary. But the far greater number of inſects lay them one by one. There are ſome which lay a conſiderable number at the ſame time. The large blue fleſh-fly (*muſca carnaria*) when it finds carrion in a proper ſtate for the reception of its eggs, depoſits a good number of them at once in the ſame place; but when it does not find a proper ſituation, in which to depoſit its eggs, it can refrain for ſome time, till it find a proper place and opportunity. There are ſome inſects that do not lay their eggs till a very long time after copulation; bees, waſps, &c. are impregnated before winter, but do not lay their eggs till ſpring.

Eggs of Inſects.

The eggs of inſects are of two ſorts; the firſt membranaceous, like the eggs of the tortoiſe, and the other reptiles; the other covered with a ſhell like thoſe of the birds; their figure varies exceedingly; ſome are round, ſome elliptical, ſome lenticular, ſome cylindrical, ſome pyramidal, ſome flat, ſome ſquare, but the round and oval are the moſt common. The eggs of inſects ſeldom increaſe in ſize, from the time they have been depoſited by the parent till they are hatched. Thoſe of the *tenthredo*, however, and of ſome others, are obſerved to increaſe in bulk.

At firſt there is nothing to be perceived in the eggs of inſects but a watery fluid; after ſome little time an obſcure point is obſervable in the centre; which, according to Swammerdam, is not the inſect itſelf, but only its head, which firſt acquires conſiſtence and colour. And the ſame author alleges, that inſects do not increaſe in bulk in the egg, but that their parts only acquire ſhape and conſiſtence. Under the ſhell of the egg there is a thin and very delicate pellicle, in which the inſect is enveloped, which may be compared to the chorion and amnios which ſurround the fœtus in quadrupeds. The little inſect remains in the egg till the fluids are diſſipated, and till its limbs have acquired ſtrength to break the egg, and make its eſcape. The different ſpecies of inſects remain incloſed in the egg for very different periods. Some continue incloſed only a few days, others remain for ſeveral months. The eggs of many inſects remain without being hatched during the whole winter; and the young inſects do not come forth from them till the ſeaſon at which the leaves of the vegetables on which they feed begin to expand. When the inſects are ready to break their priſon, they commonly attempt to pierce the ſhell with their teeth, and form a circular hole, through which they put forth firſt one leg, and then another, till they extricate themſelves entirely.

Number of Inſects.

Inſects are by far the moſt numerous claſs of animals. About eleven thouſand ſpecies have been deſcribed by Gmelin in the laſt edition of the Syſtem of Nature. A great many more have been deſcribed by other naturaliſts ſince the publication of that work, and a very conſiderable number are to be met with in the cabinets of the curious, which have not as yet been deſcribed by any author.

In thoſe parts of the world which we are beſt acquainted with, we may eaſily ſuppoſe that many ſpecies of inſects exiſt which have hitherto eſcaped notice. The minuteneſs of ſome inſects makes them eaſily overlooked; the agility of others renders the catching of them difficult. The retired ſituations which many of them haunt favour their concealment. In the unexplored parts of America, Africa, and Aſia, many hundred ſpecies muſt exiſt utterly unknown to naturaliſts. All theſe circumſtances render it very probable that not one half of the inſects which exiſt in the world have hitherto been deſcribed.

Utility of Inſects.

Inſects afford nouriſhment to a great number of the ſuperior animals; many of the fiſhes, reptiles, and birds, draw the principal part of their ſubſtenance from that ſource. The immenſe ſwarms of different ſpecies of crab which abound in every ſea, directly or indirectly form the principal part of the food of the cod, haddock, herring, and a great variety of fiſhes. The ſnake, lizard, frog, and many other reptiles, feed both on land and aquatic inſects. Gallinacious fowls, and many of the ſmall birds, &c. feed on inſects. Swallows, indeed, feed entirely on winged inſects. They afford food likewiſe to many of the mammalia, viz. to many ſpecies of the bat, to the ant-eater, &c. and even to man himſelf. Many ſpecies of crab, viz. lobſter, common crab, ſhrimp, prawn, landcrab, &c. are reckoned delicacies. The larvæ of ſome coleopterous inſects and locuſts form part of the food of man.

Inſects likewiſe by conſuming decayed animal and

History. vegetable matter, which if left to undergo the putrefactive proceſs, on the ſurface of the ground, might taint the atmoſphere with peſtilential vapours, preſerve the air pure for the reſpiration of man and other animals.

Preſervation of Inſects in Cabinets.

In collecting inſects, both male and female ought if poſſible to be procured; and the time of the year when they are taken ought to be noted. Specimens with injured wings or antennæ muſt be rejected.

For collecting inſects in their perfect ſtate, a ſort of forceps are made uſe of, which have their extremities covered with gauze. Beſides theſe the entomologiſt, in his walks, ſhould be furniſhed with a pincuſhion, ſtored with pins of various ſizes, and a tin box lined with cork, of a convenient ſize for the pocket, in which the inſects when caught are to be placed; the lepidopterous inſects being firſt carefully killed by ſqueezing their thorax, leſt their fluttering ſhould injure their wings. Coleopterous inſects are moſt expeditiouſly killed by being immerſed in boiling water; and thoſe who prefer this method may carry them home without injury in common pillboxes. Moſt inſects are killed with a few drops of ſpirit of turpentine; the lepidoptera and hymenoptera may eaſily be killed by being ſtuck through with a pin dipt in aquafortis. When the inſects are killed they are to be transfixed with pins, their wings, antennæ, and feet ſpread out and kept diſplayed. In ſome of the lepidoptera, two ſpecimens ſhould be preſerved; the wings in the one diſplayed, and in the other placed as much as poſſible in their natural poſition.

Inſects may likewiſe be collected by breeding them from their larvæ; and this, when it is convenient, is by far the beſt method for procuring fine ſpecimens; it is chiefly practiſed with the lepidopterous kinds. When the caterpillars are taken, they are to be fed on the leaves of the plant or tree on which they were found, and kept in a box with ſome moiſt earth at the bottom; they will afterwards turn into a chryſalis, either by going into the earth, by ſpinning a web and enclofing themſelves in it, or by changing into a pupa *obtecta*, according to their kinds. Having continued in this ſtate their appointed time, the perfect inſect will come forth, and muſt then be killed before it has injured its wings by flying. History.

Lepidopterous inſects are likewiſe to be collected in their pupa ſtate, by ſeeking for them under the projections of garden walls, pales, and out-houſes, ſummer-houſes, &c. or by digging for them in the winter months under the trees they feed on. When thus dug up, they are to be put into a box with moiſt earth, and kept till they come out.

When the inſects are prepared in this manner, they are to be placed in the cabinet, which may conſiſt of boxes or drawers deep enough to hold a long pin, and lined on the bottom with cork, or with wax; the inſects of each order in drawers by themſelves; and the different genera cloſe together. The generic and trivial name of each inſect is to be written on a piece of paper, fixed to the bottom by the ſame pin which ſupports the inſect. The drawers muſt be made to ſhut very cloſe, ſo as to exclude the duſt and minute inſects; ſome cover them with glaſs. A little camphor in each drawer is likewiſe uſeful.

Inſects of the aptera order, ſuch as ſpiders, ſcolopendræ, juli, &c. are beſt preſerved in ſome kind of ſpirits. The oniſci and cancri may be preſerved like beetles.

HISTORY OF ENTOMOLOGY.

THOUGH the attention of man muſt have been attracted by the vegetables and animals with which he found himſelf ſurrounded, and by the earth and minerals on which he trod, even at the very earlieſt periods of human ſociety, yet a very conſiderable time muſt have elapſed before any attempts were made at arrangement or claſſification. Ariſtotle was the firſt (as far as we know) who deſerved the name of natural hiſtorian; his arrangement of animals was the only one followed for many centuries. He divided all animals into viviparous and oviparous; the firſt contained quadrupeds, the ſecond birds, fiſhes and inſects. Under inſects were comprehended all ſmall animals whoſe bodies were divided into ſegments. This definition of inſects was followed by all natural hiſtorians down to the time of Linnæus.

Theophraſtus, the diſciple of Ariſtotle, the only other perſon among the ancient Greeks who deſerves the name of natural hiſtorian, beſtowed the moſt of his attention on vegetables and minerals. Pliny has given us an account of all that was known in natural hiſtory down to his own times. Though he has mentioned many inſects, owing to his want of method little is to be learnt from him reſpecting entomology. Dioſcorides, who was nearly cotemporary with Pliny, has confined himſelf chiefly to natural hiſtory connected with medicine. He has given an enumeration of all the natural bodies which entered into the materia medica. On the reviſal of learning in Europe, writers on natural hiſtory ſeemed to have confined themſelves to writing commentaries on the ancients; and nothing was done in entomology till the times of Geſner, who was the greateſt naturaliſt the world had ſeen from the time of Ariſtotle, and who was the firſt who made a collection of the objects of natural hiſtory, and formed a muſeum. He was born in Zurich in 1516, and died in 1565. Aldrovandus lived nearly about the ſame time with Geſner, and, like him, formed a muſeum which ſerved for the foundation of the public muſeum at Bologna, where many ſpecimens may be ſtill ſeen marked with the venerable hand of the firſt collector. Geſner formed his zoology on the principles of Ariſtotle: his hiſtory of animals is very voluminous. Aldrovandus made a collection of all that had been written on natural hiſtory before his own time, without diſcriminating truth from fiction. He has given a methodical arrangement of inſects in the ſeventh book of his large work publiſhed in 1602. He followed nearly the ſame arrangement with Geſner. Geſner, in conjunction with ſome other natural hiſtorians, wrote a treatiſe on inſects, which was publiſhed by Mouffet,

History. Mouffet, an Engliſh phyſician. About this time our countryman, the illuſtrious Harvey, ventured to controvert Ariſtotle's erroneous opinion with reſpect to equivocal generation. Though his aphoriſm, *omnia ex ovo*, at firſt met with great oppoſition, it was at laſt eſtabliſhed by his own experiments and thoſe of Redi and Malpighi. From this period the writers on entomology have been numerous; we ſhall content ourſelves here with giving little more than an enumeration of the principal works on the ſubject.

Agricola. in a work entitled *de Animantibus Subterraneis*, publiſhed in 1549, has given a methodical arrangement of inſects: he divides them into, 1 Creeping inſects; 2. Flying inſects; and 3. Swimming inſects. After giving this arrangement, he proceeds to give an account of each ſpecies.

A work entitled *Theatrum Inſectorum Thomæ Mouffeti opera concinnatum*. Lond. 1634, the joint labour of ſeveral of the moſt eminent natural hiſtorians who lived about the middle of the ſixteenth century, though not publiſhed till 1734, about 30 years after the death of Mouffet, by whoſe care the work had been abridged, and prepared to meet the public eye, is the next worthy of notice. It is divided into two books; the firſt treats of winged inſects; the ſecond of inſects without wings: theſe two grand diviſions are ſubdivided into ſeveral families characterized by the number and poſition of the legs. There is but little method diſplayed in the arrangement of the inſects which compoſe the different families.

Aldrovandus divides inſects into *terreſtria et aquatica*; (land inſects, and aquatic inſects.) The different orders and ſubdiviſions of theſe two claſſes, are for the moſt part determined by the number, nature and poſition of their wings and legs. He calls his firſt order *Favifica*, (thoſe which form combs). As to the reſt, according to his own declaration, he follows Ariſtotle.

Wolfang Frenzius, in his *Hiſtoria Animalium ſacra*, publiſhed in 1612, has divided inſects into three claſſes, viz. 1. *Aeria*, (ſuch as fly); 2. *Aquatica*, (ſuch as inhabit the water). 3. *Terrea et Reptentia*, (ſuch as creep about, or are lodged in the earth. His deſcriptions are much more accurate than thoſe of any of the authors who preceded him.

John Johnſton has borrowed freely from his predeceſſors, in his *Hiſtoria Naturalis Inſectorum*, publiſhed in 1653. He divides inſects into *terreſtria* and *aquatica*, (into land and aquatic inſects): the land inſects he divides into three orders; 1. Such as have wings and legs; 2. Such as have legs without wings; and 3. Such as have neither wings nor legs. Theſe three orders occupy his three firſt books; his fourth contains aquatic inſects.

Walter Charleton follows the ſyſtem of Aldrovandus in his *Onomaſticon Zoicon*, publiſhed in 1668.

Jo. Goodart publiſhed *Metamorphoſis et Hiſtoria Naturalis de Inſectis*, 8vo. Mediob. 1667.

Likewiſe in 1675, a work of his appeared, *de Inſectis in Methodum redactis, opera Mart. Liſter*. Ebor. In this work inſects are divided into ten families: the 1ſt includes butterflies with erect wings; 2d, Butterflies with horizontal wings; 3d, Butterflies with deflected wings; 4th, Libellulæ, (Dragon-flies); 5th, Apes, (bees); 6th, Coleopterous inſects; 7th, Locuſts, and grashoppers; 8th, Flies correſponding to the order diptera of Linnæus; 9th, Millepeds; and 10th, Spiders. This work is full of typographical errors and miſtakes in natural hiſtory. History.

The diſcovery of the microſcope in 1618, tended greatly to the advancement of entomology, as by means of it the moſt minute parts of inſects could be viewed, and their organization examined. Naturaliſts were much engaged in making microſcopic diſcoveries, particularly Borel, Rhedi, Swammerdam, Bonanni, Bonomo, Leeuwenhoek and Joblot.

John Swammerdam, in his *Biblia Naturæ*, publiſhed in 1669, has divided inſects into four claſſes.

John Ray publiſhed his *Hiſtoria Inſectorum*. Lond. 1710. This work was properly the joint production of J. Ray and Francis Willoughby. Theſe illuſtrious friends laboured together with uncommon ardour in the ſtudy of nature. Death carried off Willoughby in the prime of life, before he had properly digeſted what the induſtry of his early years had collected; and his labours would have been loſt to the world, and his name might have ſunk in oblivion, but for the friendſhip of Ray. So cloſe was the intercourſe between theſe two naturaliſts, and ſo intimately were their labours blended together, that it is not eaſy to aſſign each his due ſhare of merit. Indeed Ray has been ſo partial to the fame of his departed friend, and has cheriſhed his memory with ſuch affectionate care, that we are in danger of attributing too much to Mr Willoughby, and too little to himſelf. Though what Dr Derham aſſerts be not correct, that Mr Willoughby had taken the animal kingdom for his taſk, and Mr Ray the vegetable one, yet it is generally agreed, that the *Hiſtoria Inſectorum* is principally to be aſcribed to Willoughby. In that work inſects are divided into *Tranſmutabilia et Intranſmutabilia*, (thoſe which undergo a metamorphoſis, and thoſe which undergo none). Theſe two grand diviſions are ſubdivided into ſeveral orders, which are aſcertained by the number of their legs, or total want of legs; by the places which they inhabit; by their ſize; by the configuration of the various parts of the body; by the ſmell which they diffuſe, &c. The *tranſmutabilia* are divided into four orders. 1. *Vaginipennes*, (thoſe which have their wings covered with a ſheath). 2. *Papiliones*, (lepidopterous inſects). 3. *Quadripennes*, (thoſe which have four wings); and 4. *Bipennes*, (thoſe which have two). The papiliones, quadripennes, and bipennes are again ſubdivided into families, the characters of which are taken, either from the appearance and conformation of their larvæ, or from the form, colour and different properties of the perfect inſect.

Eleazar Albin publiſhed a natural hiſtory of Engliſh inſects in 1720. He likewiſe publiſhed the Natural Hiſtory of Spiders in 1736.

Antony Valiſnieri, in his work entitled *Eſperienze e Oſſervazioni intorno agli Inſetti*, publiſhed in 1730, has divided inſects into four orders, according to the ſituation in which they paſs their lives.

Mary Sybelle Merian, publiſhed in 1730, *Hiſtoire d'Inſectes d'Europe et de Surinam*. She likewiſe publiſhed in 1705, *Metamorphoſis Inſectorum Surinamenſium ad vivum picta et deſcripta*; and in 1717, *Erucarum Ortus*.

George Bernard Rhump publiſhed in 1705, and again in 1741, a work entitled *Amboiniſche Rarietatkammer*.

History. Hans Sloane, in the years 1707 and 1725, published a Voyage to the Islands of Madeira, Barbadoes, Nevis, Saint Christophers and Jamaica.

Henry Ruisch in 1710 and 1718 published *Theatrum Universale omnium Animalium.*

J. Petiver published in 1715 his *Icones et Nomina Aquatilium Animalium Amboinæ.*

Richard Bradley published in 1721 his Philosophical Account of the Works of Nature.

Linnæus, the most celebrated natural historian the world ever produced, in his first edition of the *Systema Naturæ*, published in 1735, divided insects into four orders, from the number and different appearances of their wings; 1. *Coleoptera;* 2. *Angioptera;* 3. *Hemiptera;* and 4. *Aptera.* This was but an imperfect sketch, a first essay. In the subsequent editions of the System of Nature which he published, to the number of twelve, he completed the arrangement of insects, of which we need say nothing here, as we have followed it in preference to all others; and most authors who have written on the subject for more than half a century past have either followed it closely, or with very slight alterations. His extensive genius embraced all the three kingdoms of nature. In botany and entomology in particular he far excels all who went before him, and as yet remains unrivalled. Writers on entomology became so numerous after Linnæus had published his System of Nature, and established entomology on a solid foundation, that a mere enumeration of their names and titles of their books would occupy more room than we can afford to bestow on this article; we shall therefore only notice a few of the most remarkable.

Charles Degeer, in his *Memoires pour servir à l'Histoire des Insectes*, in 1752, has arranged insects into fourteen orders, distinguished by the different appearances of the various parts which compose their bodies, particularly the elytra, wings, and most remarkable parts of the head. He published again in 1778.

M. de Reaumur published his *Memoires pour servir à l'Histoire des Insectes* at Paris in 1737. No one has paid so much attention to the habits of insects, and to every thing that concerns them, as Reaumur. He ought to be read by every student of entomology.

John Retzius, has simplified the arrangement of Degeer, in a small work entitled *Genera et Species Insectorum.* But although in this arrangement he has followed the method of Degeer, the terms he has made use of are principally those of Linnæus. His 14 orders are, 1. Lepidoptera. 2. Alinguia. 3. Neuroptera. 4. Hymenoptera. 5. Siphonata. 6. Dermaptera. 7. Hemiptera. 8. Coleoptera. 9. Hasterata. 10. Proboscidea. 11. Suctoria. 12. Ancenata. 13. Atrachelia. 14. Crustacea.

M. Geoffroy, in his *Histoire Abrègè des Insectes*, published at Paris in 1762, has divided insects into six orders; Coleopteres, Hemipteres, Tetrapteres ailes farineuses, Tetrapteres ailes nues, Dipteres, and Apteres. He determined his families by the number of the articulations of the feet, and his genera by characters drawn from all the parts of the body. He has formed a great number of new genera.

John Antony Scopoli, in his *Entomologia Carniolica*, published in 1762, has followed the arrangement of of Linnæus, and only changes the names of some of the orders; *e. g.* Proboscidea, instead of Hemiptera; Aculeata, instead of Hymenoptera; Halterata, instead of Diptera; and Pedestria, instead of Aptera. History.

J. C. Schæffer published in 1766, *Elementa Entomologica*, 135 *tabulæ ære excussæ;* he follows in many points the method of Linnæus. He divides insects into seven classes. 1. Coleoptero-macroptera. 2. Coleoptero-microptera. 3. Hemiptera. 4. Hymeno-lepidoptera. 5. Hymeno-gymnoptera. 6. Diptera; and 7. Aptera. His first and second classes correspond with the Coleoptera of Linnæus; the fourth with the Lepidoptera, and the fifth with the Hymenoptera.

John C. Fabricius is the founder of a new system of Entomology, which he published in his *Systema Naturæ* 1775. He discriminates his orders and genera, by the parts of the mouth, (*instrumenta cibaria*). He afterwards published *Species Insectorum*, *Entomologia Systematica*, and *Mantissa Insectorum.*

The arrangement of Fabricius has acquired great reputation, especially on the continent. It may not therefore be amiss to give a slight view of it. He divides insects into eight classes.

Class I.	ELEUTHERATA.	Mouth armed with jaws, and four or six feelers. The jaws naked and free.
Class II.	ULANATA.	The jaws covered with an obtuse helmet.
Class III.	SYNISTATA.	The jaws united with the lip.
Class IV.	AGONATA.	The under jaw wanting.
Class V.	UNOGATA.	Mouth armed with jaws and two feelers; the under jaw generally furnished with a small unguis or nail.
Class VI.	GLOSSATA.	Mouth furnished with feelers, and a spiral tongue.
Class VII.	RHYNGOTA.	Mouth furnished with a snout, and an articulated sheath.
Class VIII.	ANTLIATA.	Mouth furnished with a haustellum and a sheath not articulated.

In a supplement to his *Entomologia Systematica*, he has divided insects into thirteen orders. 1. Eleutherata. 2. Ulonata. 3. Synistata. 4. Piezata. 5. Odorata. 6. Mitosata. 7. Unogata. 8. Polygonata. 9. Kleistagnatha. 10. Exochnata. 11. Glossata. 12. Rhyngota 13. Anthliata. He has lately published a work entitled *Systema Eleutheratorum*, no more than two volumes of which have as yet made their appearance.

Moses Harris published an Exposition of English Insects, &c. with coloured plates, 1776.

Jo. Christ published *Philosophia Entomologica sistens scientiæ fundamenta*, &c. Hamb. 1778, 8vo.

Archiv der Insektengeschichte herausgege bevon. Joh. Casp. Fuesly. Zurich, 1781.

Fr. Paulla, v. Schrank; *Enumeratio Insectorum Austriæ indigenorum.* Aug. Vindel. 1781.

P. Sim. Pallas; *Icones Insectorum.* Hamb. 1781.

A. W. Knock; *Beytraege zur Insektengeschichte*, 1781.

James Barbut published the *Genera Insectorum* of Linnæus, exemplified by various specimens of English insects drawn from nature. Lond. 1781.

John Nepomuk de Laicharting, has divided insects into ten orders, characterized by the configuration of various parts of the body. He adheres pretty closely to the

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

Fig. 8.

Fig. 9.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 10.

Fig. 14.

Fig. 15.

Order 1. Coleoptera.

Fig. 16. Scarabaeus Hercules.
Hercules Beetle.

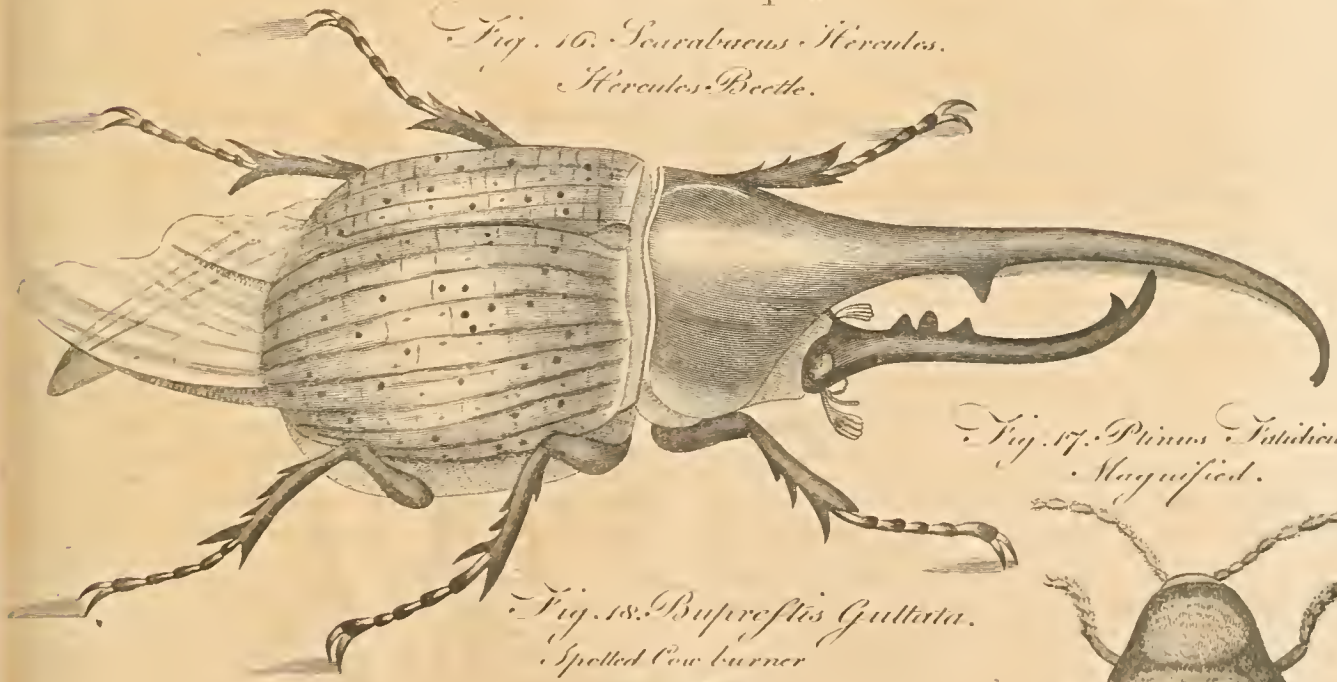


Fig. 17. Ptinus Fatidicus.
Magnified.

Fig. 18. Buprestis Guttata.
Spotted Cow burner

Fig. 19. Carabus Vulgaris.
Common Carabus.

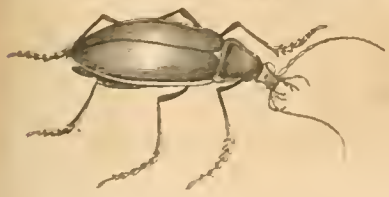


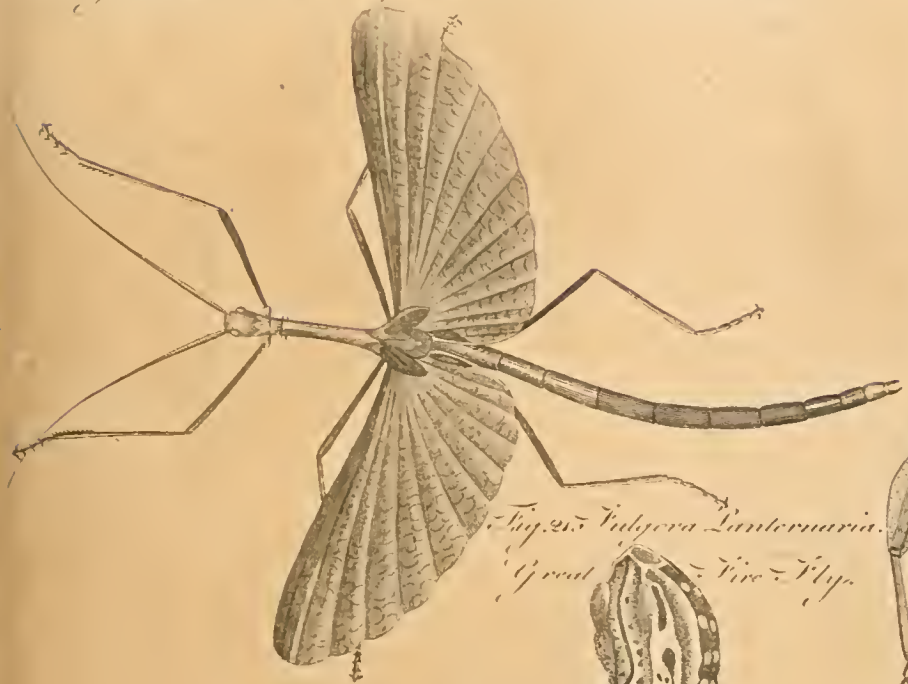
Fig. 19. Carabus Coriaceus.
Shagreen Carabus.

Fig. 17.
Ptinus Fatidicus.
Death watch.

Wm. Clift, Conservator, Royal College of Surgeons, fecit.

Fig. 20. Mantis Bispinosa.

Fig. 21. Mantis Foliifolia. the Walking Leaf.



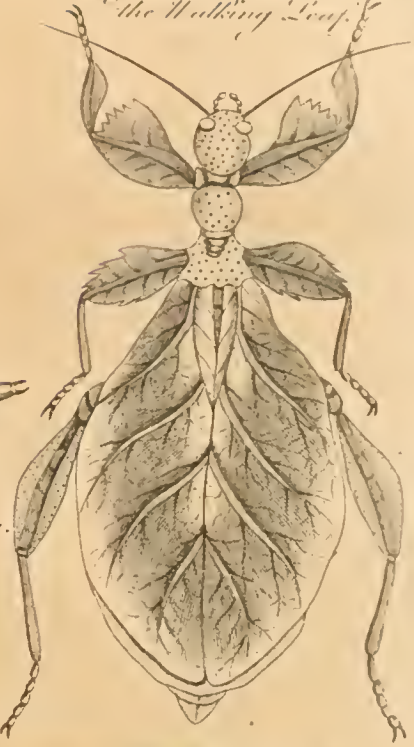


Fig. 23. Cimex Bug.

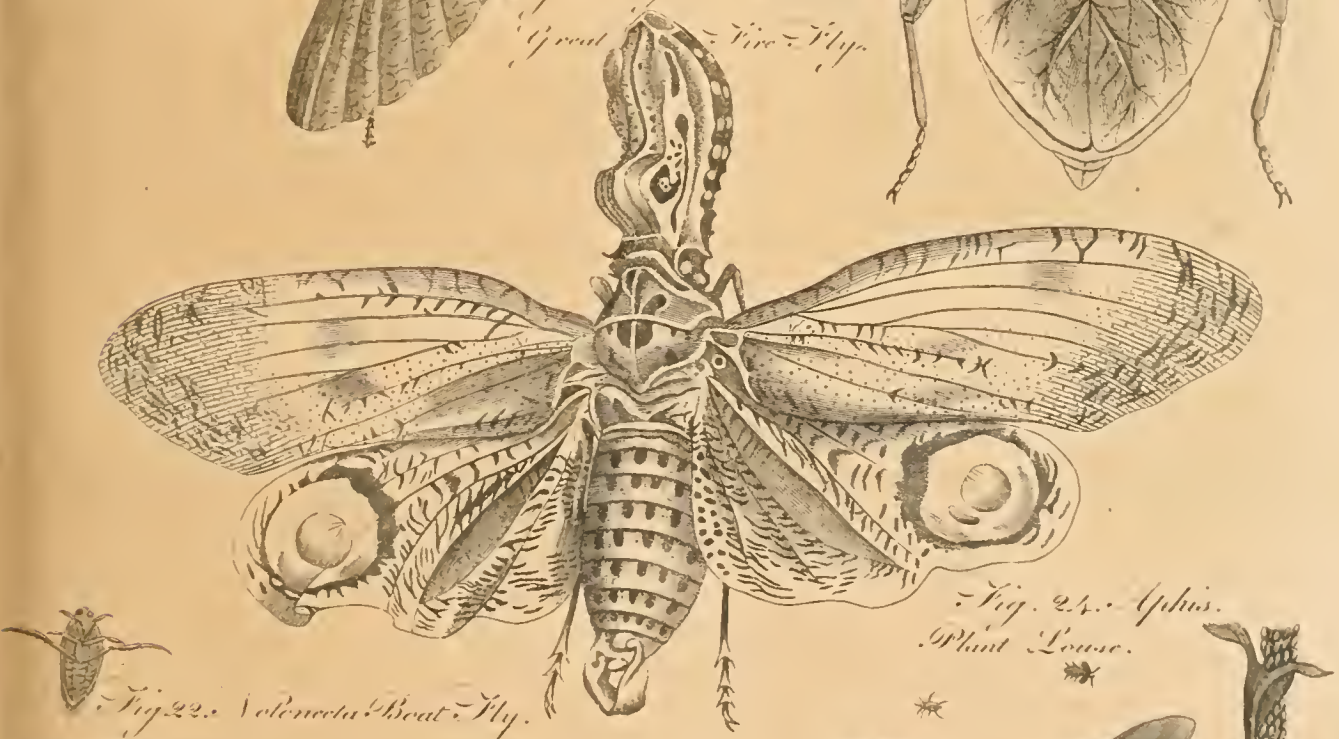


Fig. 25. Coccus.

Fig. 22. Volucella Beat Fly.

Fig. 24. Aphis. Plant Louse.

Hill Chin. Mal. Sculptor fecit.

Order III. Lepidoptera.

Fig. 26. Papilio.

Fig. 27. Sphinx.

Fig. 28. Phalaena.

Order IV. Neuroptera.

Fig. 30. Hemerobius.

Fig. 30.

Fig. 29. Libellula. Dragon Fly.

Fig. 31. Panorpa.

Abbott & Pinnock Sculpt. Liverpool

ENTOMOLOGY.

Plate CCVI.

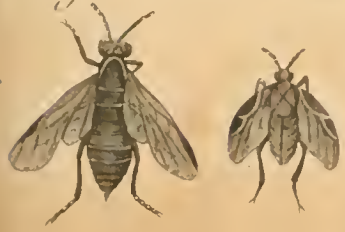
Order V. Hymenoptera.

Fig. 32. Tenthredo.

Fig. 33. Ichneumon.

Fig. 34. Chrysis.

Fig. 35. Formica.



Order VI. Diptera.

Fig. 36. Oestrus.

Fig. 37. Tipula.

Fig. 38. Asilus.

Fig. 39. Lepisma

Order VII. Aptera.

Fig. 40. Aranea. Spider.

Fig. 42. Cancer

Fig. 41. Scorpio.

Fig. 43. Scolopendra.

Abell Print. & Pub. Co. Sculpsit fecit

History

the method of Linnæus. His orders are, 1. Scarabæoides. 2. Grylloides. 3. Cimicioides. 4. Papilionoides. 5. Libelluloides. 6. Veſpoides. 7. Muſcoides. 8. Cancroides. 9. Aranoides, and 10. Oniſcoides.

Olivier, in 1789, publiſhed *Entomologie, ou Hiſtoire Naturelle des Inſectes*, in 3 vols. 4to. Paris. In 1790, in the *Dictionnaire des Inſectes*, forming a part of the *Encyclopedie Methodique*, he has given an arrangement of inſects little different from that of Linnæus. He has added one order which he calls Orthopteres, diſtinguiſhed by the mode of folding the lower wings, and a part on the head, which he terms *galea*. He has likewiſe ſubdivided the order Aptera, into Arachnides and Cruſtaces. Latreille in 1795, in a work entitled *Precis du Caractere des Genres*, divides inſects into two grand diviſions, viz. *inſectes ailès, et inſectes apteres*, (winged inſects, and inſects without wings). Theſe two grand diviſions he ſubdivides into 14 orders. 1. Coleopteres. 2. Orthopteres. 3. Hemipteres. 4. Neuropteres. 5. Lepidopteres. 6. Suceurs. 7. Thyſanoures. 8. Paraſites. 9. Acephalés. 10. Entomoſtraces. 11. Cruſtaces. 12. Myriapodes. Since that he has publiſhed a more detailed account of this method in a work entitled *les Genres et les Familles des Inſectes*.

Clairville in 1798, in the introduction to his *Entomologie Helvetique*, has given an arrangement of inſects, in which he differs from Linnæus almoſt in nothing, except in the names of his orders, viz. Elytropteres, Dictyopteres, Thlebopteres, Haltipteres, Lepidopteres, Hemiſopteres, Rophoteires, and Pododuneres.

Link, in his *Magaſin fur Thiergeſchite*, has divided inſects into eleven orders; he follows de Laicharting almoſt in every thing, even in the names of his orders; he has indeed added an order which he calls Pediculoides.

Cuvier and Dumeril, in their Comparative Anatomy, have very nearly followed the method of Linnæus; they have however divided the order Aptera into two, viz. Gnathaptera and Aptera; they have likewiſe altered the arrangement of the orders, and have placed thoſe firſt which contain inſects furniſhed with jaws, viz. Gnathaptera, Neuroptera, Hymenoptera, Coleoptera, and Orthoptera; and have thrown thoſe laſt which are deſtitute of jaws, viz. Hemiptera, Lepidoptera, Diptera and Aptera.

We ſhall refrain from noticing thoſe authors who have written partial treatiſes; though there are ſeveral works of that kind which the entomologiſt might peruſe with advantage, ſuch as the *Fauna Suecica*, publiſhed in 1761 by Linnæus, at Stockholm. *Fauna Germanica*, by Panzer. *La Faune Pariſienne de Walknair*. Kirby's *Monographia apum Angliæ*. Latreille's treatiſe on Ants.

EXPLANATION OF THE PLATES.

PLATE CCIII.

Fig. 1. ANTENNÆ PECTINATÆ, or feathered; as in the *phalæna*, moths.

2. ——— PERFOLIATÆ, or perfoliated; as in the *dermeſtes* and *dytiſcus*.

——— FISSILES, or fiſſile, divided into laminæ at the extremity, as in the *ſcarabæi*, beetles.

4. ——— CLAVATÆ, or club-ſhaped, as in the *papilio*, butterfly.

5. ——— MONILIFORMES, like a necklace of beads; as in the *chryſomela*.

6. ——— SETACEÆ, ſetaceous, or briſtle-ſhaped; as in many of the *phalænæ*.

7. ——— ARISTATÆ, furniſhed with a lateral hair, as in the *fly*.

8. 9. *a*, Caput, the head.
b, Palpi, or feelers.
c, Antennæ, or horns.
d, Oculi, the eyes.
e, Thorax.
f, Scutellum, or eſcutcheon.
g, Pectus, or breaſt.
h, Sternum, or breaſt-bone.
i, Abdomen, and its ſegments.
k, Anus.
l, Elytra, or ſhells.
m, Membranous wings.
n, Pedes, or feet, which are natatorii.

10. *o*, Femur, or thigh.
p, Tibia, or leg.
q, Tarſus, or foot.
r, Unguis, or claw.

11. *a*, The anterior part of the wing.
b, The poſterior part.
c, The exterior part.
d, The interior part.
e, The margin.
f, The diſk, or middle.
g, Oculus, or eye.

12, 13, 14, 15. Repreſent the inſect in its egg, caterpillar, pupa, and perfect ſtate.

Order I. COLEOPTERA. Fig. 16. *Scarabæus*. Fig. 17. *Ptinus*. Fig. 18. *Bupreſtis*. Fig. 19. *Carabus*.

Order II. Fig. 20. *Mantis*. Fig. 21. *Fulgora*. Fig. 22. *Notonecta*. Fig. 23. *Cimex*. Fig. 24. *Aphis*. Fig. 25. *Coccus*.

Order III. Fig. 26. *Papilio*. Fig. 27. *Sphinx*. Fig. 28. *Phalæna*.

Order IV. Fig. 29. *Libellula*. Fig. 30. *Hemerobius*. Fig. 31. *Panorpa*.

Order V. Fig. 32. *Tenthredo*. Fig. 33. *Ichneumon*. Fig. 34. *Chryſis*. Fig. 35. *Formica*.

Order VI. Fig. 36. *Oeſtrus*. Fig. 37. *Tipula*. Fig. 38. *Aſilus*.

Order VII. Fig. 39. *Lepiſma*. Fig. 40. *Aranea*. Fig. 41. *Scorpio*. Fig. 42. *Cancer*. Fig. 43. *Scolopendra*.

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ENT

Entrepas || Entry.

ENTREPAS, in the manege, a broken pace or going, that is neither walk nor trot, but has ſomewhat of an amble.

This is a pace or gait of ſuch horſes as have no reins or back, and go upon their ſhoulders; or, of ſuch as are ſpoiled in their limbs.

ENTRING LADDERS, in a ſhip, are of two ſorts; one uſed by the veſſel's ſides, in a harbour, or in fair weather, for perſons to go in and out of the ſhip: the other is made of ropes, with ſmall ſtaves for ſteps; and is hung out of the gallery to enter into the boat, or to come aboard the ſhip, when the ſea runs ſo high that they durſt not bring the boat to the ſhip's ſide for fear of ſtaving it.

ENTROCHUS, in *Natural Hiſtory*, a genus of extraneous foſſils, uſually of about an inch in length, and made up of a number of round joints, which, when ſeparate and looſe, are called *trochitæ*: they are compoſed of the ſame kind of plated ſpar with the foſſil ſhells of the echini, which is uſually of a bluiſh-gray colour, and very bright where freſh broken; they are all ſtriated from the centre to the circumference, and have a cavity in the middle.

The entrochi are found of all ſizes, from that of a pin's head to a finger's length, and the thickneſs of one's middle finger; and are plainly of marine origin, having often ſea-ſhells adhering to them. They ſeem to be the petrified arms of that ſingular ſpecies of the ſea ſtar fiſh, called *ſtella arboreſcens*.

ENTRY, in *Law*, ſignifies taking poſſeſſion of lands or tenements, where a perſon has a right ſo to do.

Entry of an Heir, in *Scots Law*, that form of law by which an heir veſts in himſelf a proper title to his predeceſſor's eſtate.

Bill of ENTRY, in commerce. See BILL.

In making entries inwards, it is uſual for merchants to include all the goods they have on board the ſame ſhip in one bill, though ſometimes they may happen to be upwards of 20 ſeveral kinds: and in caſe the goods are ſhort entered, additional or poſt entries are now allowed; though formerly the goods ſo entered were forfeited. As to bills of entry outwards, or including goods to be exported, upon delivering them, and paying the cuſtoms, you will receive a ſmall piece of parchment called a *cocket*, which teſtifies your payment thereof, and all duties for ſuch goods.

If ſeveral ſorts of goods are exported at once, of which ſome are free, and others pay cuſtoms; the exporter muſt have two cockets, and therefore muſt make two entries; one for the goods that pay, and the other for the goods that do not pay cuſtom.

Entries of goods, on which a drawback is allowed, muſt likewiſe contain the name of the ſhip in which the goods were imported, the importer's name, and time of entry inwards. The entry being thus made, and an oath taken that the cuſtoms for thoſe goods were paid as the law directs, you muſt carry it to the collector and comptroller, or their deputies; who, after examining their books, will grant warrant, which muſt be given to the ſurveyor, ſearcher, or land-waiter, for them to certify the quantity of goods; after which the certificate muſt be brought back to the collector and comptroller, or their deputies, and oath made that the ſaid goods are really ſhipped, and not landed again in any part of Great Britain.

EON

Envelope || Eonians.

ENVELOPE, in *Fortification*, a work of earth, ſometimes in form of a ſimple parapet, and at others like a ſmall rampart with a parapet: it is raiſed ſometimes on the ditch, and ſometimes beyond it.

ENVIRONNE', in *Heraldry*, ſignifies ſurrounded with other things: thus, they ſay, a lion environné with ſo many bezants. See BEZANTS.

ENUMERATION, an account of ſeveral things, in which mention is made of every particular article.

ENUMERATION, in *Rhetoric*, a part of peroration; in which the orator, collecting the ſcattered heads of what has been delivered throughout the whole, makes a brief and artful relation or recapitulation thereof.

ENVOY, a perſon deputed to negotiate ſome affair with any foreign prince or ſtate. Thoſe ſent from the courts of Britain, France, Spain, &c. to any petty prince or ſtate, ſuch as the princes of Germany, the republics of Venice, Genoa, &c. go in quality of envoys, not ambaſſadors; and ſuch a character only do thoſe perſons bear, who go from any of the principal courts of Europe to another, when the affair they go upon is not very ſolemn or important. There are envoys ordinary and extraordinary, as well as ambaſſadors; they are equally under the protection of the law of nations, and enjoy all the privileges of ambaſſadors; only differing from them in this, that the ſame ceremonies are not performed to them.

ENVY, in *Ethics*, pain felt; and malignity conceived, at the ſight of excellence or happineſs in another. See EMULATION.

EON, or ÆON. See ÆON.

EONIANS, in church-hiſtory, the followers of Eon, a wild fanatic of the province of Bretagne, in the 12th century, whoſe brain was diſordered. He concluded from the reſemblance between *eum*, in the form for exorciſing malignant ſpirits, viz. *Per eum, qui venturus eſt judicare vivos et mortuos*, and his own name Eon, that he was the ſon of God, and ordained to judge the quick and dead. Eon, however, was ſolemnly condemned by the council at Rheims, in 1148, at which Pope Eugenius III. preſided, and ended his days in a

Eoria ‖ Epacts.

miſerable priſon. He left behind him a number of followers and adherents, whom perſecution and death ſo weakly and cruelly employed could not perſuade to abandon his cauſe, or to renounce an abſurdity which, ſays Moſheim, one would think could never have gained credit but in ſuch a place as Bedlam.

EORIA, in *Mythology*, a feaſt celebrated by the Athenians in honour of Erigonus, who, by way of puniſhment for their not avenging the death of his father Icarus, engaged the gods to inflict the curſe on their daughters that they ſhould love men who never returned their paſſion. The feaſt was inſtituted by the order of Apollo.

EOSTRE, in *Mythology*, a Saxon goddeſs to whom they ſacrificed in the month of April, called the month of *Eoſtra*; and thence the name *Eaſter*, which the Saxons retained after their converſion to Chriſtianity, applying it to the feſtival celebrated in commemoration of our Saviour's reſurrection.

EPACRIS, a genus of plants belonging to the pentandria claſs. See BOTANY *Index*.

EPACTS, in *Chronology*, the exceſſes of the ſolar month above the lunar ſynodical month, and of the ſolar year above the lunar year of twelve ſynodical months; or of ſeveral ſolar months above as many ſynodical months, and ſeveral ſolar years above as many dozen of ſynodical months.

The epacts, then, are either *annual* or *menſtrual*.

Menſtrual epacts are the exceſſes of the civil or kalendar month above the lunar month. Suppoſe, c. gr. it were new moon on the firſt day of January; ſince the lunar month is 29 days 12h. 44′ 3″, and the month of January contains 31 days, the menſtrual epact is 1 day 11h. 15′ 57″.

Annual epacts are the exceſſes of the ſolar year above the lunar. Hence, as the Julian ſolar year is 365 days 6h. and the Julian lunar year 354 days 8h. 48′ 38″, the annual epact will be 10 days 21h. 11′ 22″; that is, nearly 11 days. Conſequently the epact of 2 years is 22 days; of 3 years, 33 days; or rather 3, ſince 30 days make an *emboliſmic* or intercalary month.

Thus the epact of 4 years is 14 days, and ſo of the reſt; and thus, every 19th year, the epact becomes 30 or 0; conſequently the 20th year the epact is 11 again; and ſo the cycle of epacts expires with the golden number, or lunar cycle of 19 years, and begins with the ſame, as in the following table:

Gold. Numb.	Epacts.	Gold. Numb.	Epacts.	Gold. Numb.	Epacts.
1	XI	8	XXVIII	14	IV
2	XXII	9	IX	15	XV
3	III	10	XX	16	XXVI
4	XIV	11	I	17	VIII
5	XXV	12	XII	18	XIX
6	VI	13	XXIII	19	XXX
7	XVII				

Again, as the new moons are the ſame, that is, as they fall on the ſame day every 19 years, ſo the difference between the lunar and ſolar years is the ſame every 19 years. And becauſe the ſaid difference is always to be added to the lunar year, in order to adjuſt or make it equal to the ſolar year; hence the ſaid difference reſpectively belonging to each year of the moon's cycle is called the *epact of the ſaid year*, that is, the number to be added to the ſaid year, to make it equal to the ſolar year; the word being formed from the Greek επαγω, *induco*, *intercalo*. Epaminondas.

Upon this mutual reſpect between the cycle of the moon and the cycle of the epacts, is founded this rule for finding the Julian epact, belonging to any year of the moon's cycle. Multiply the year given of the moon's cycle into 11: and if the product be leſs than 30, it is the epact ſought; if the product be greater than 30, divide it by 30, and the remainder of the dividend is the epact. For inſtance, I would know the epact for the year 1712, which is the third year of the moon's cycle. Wherefore 3 is the epact for 1712; for 11×3=33, and 33 being divided by 30, there is left 3 of the dividend for the epact. But the difference of the Julian and Gregorian years being equal to the exceſs of the ſolar above the lunar year, or 11 days, it happens that the Gregorian epact for one year is the ſame with the Julian epact for the preceding year.

EPAMINONDAS, a celebrated Theban, the ſon of Polymnus, and one of the greateſt captains of antiquity. He learned philoſophy and muſic under Lyſis, a Pythagorean philoſopher; and was from his infancy inured to all the exerciſes of body and mind. He was learned, generous, well-ſkilled in war, brave, modeſt, and prudent; and had ſuch a regard for truth, that he would not tell a falſehood even in jeſt. He ſerved firſt under the Lacedemonians; ſaved the life of Pelopidas their chief, who received in a battle ſeven or eight wounds; and contracted a ſtrict friendſhip with that general, which laſted till his death. At his perſuaſions, Pelopidas delivered the city of Thebes from the yoke of the Spartans, who had rendered themſelves maſters of Cadmea, which occaſioned a bloody war between the two nations. Epaminondas was made general of the Thebans; on which he gained the celebrated battle of Leuctra, in which Cleombrotus, the valiant king of Sparta, was killed. He then ravaged the enemy's country, and cauſed the city of Meſſina to be rebuilt and peopled. At length, the command of the army was given to another, becauſe Epaminondas had kept his troops in the field four months longer than he had been ordered by the people; but, inſtead of retiring in diſguſt, he now ſerved as a common ſoldier, and diſtinguiſhed himſelf by ſo many brave actions, that the Thebans, aſhamed of having deprived him of the command, reſtored him to his poſt, in order to carry the war into Theſſaly, where his arms were always victorious. A war breaking out between the Elians and the inhabitants of Mantinea, the Thebans took the part of the former. Epaminondas then reſolved to endeavour to ſurpriſe Sparta and Mantinea; but not ſucceeding, he gave the enemy battle, in which he received a mortal wound with a javelin, the bearded iron remaining in the wound. Knowing that it could not be drawn out without occaſioning immediate death, he would not ſuffer it to be touched, but continued to give his orders: and on his being told, that the enemy were entirely defeated, "I have lived long enough (he cried),

Epanalepſis || Ephemeri-des.

cried), ſince I die without being conquered;" and at the ſame time he plucked the javelin from his wound, and expired, 363 B. C.

EPANALEPSIS. See ORATORY, N° 73.

EPANODOS. *Ibid.* N° 75.

EPANORTHOSIS. *Ibid.* N° 75.

EPARER, in the manege, ſignifies the ſlinging of a horſe, or his yerking and ſtriking with his hind-legs.

EPAULEMENT, in *Fortification*, a work raiſed to cover ſidewiſe, is either of earth, gabions, or faſcines loaded with earth. The epaulements of the places of arms for the cavalry, at the entrance of the trenches, are generally of faſcines mixed with earth.

EPAULETTES, are a kind of ſhoulder-knots choſen for the ſoldiers, which are to be of the colour of the facing, with a narrow yellow or white tape round it, and worſted fringe; thoſe for the officers are made of gold or ſilver lace, with a rich fringe; they are badges of diſtinction worn on one or both ſhoulders. Thoſe of the dragoon-guards, horſe, and dragoons, are worn on the left ſhoulder: the light dragoons, and officers of grenadiers, have one on each ſhoulder: thoſe of the battalion wear one on the right ſhoulder only, which is to be made of embroidery or lace with a gold or ſilver fringe. Thoſe of the royal regiment of artillery are to be gold and embroidery, with gold fringe on ſcarlet cloth, and worn on the right ſhoulder.

EPENTHESIS, in *Grammar*, the interpoſition or inſertion of a letter or ſyllable in the middle of a word; as *alituum*, for *alitum*; *relligio*, for *religio*; *induperator*, for *imperator*, &c.

EPEUS, of the line of Endymion, the inventor of the battering ram, an engine of great ſervice in ſieges to make a breach. He is thought to have built the Trojan horſe, and to have founded the city Metapontum.

EPHA, or EPHAH, in Jewiſh antiquity, a meaſure for things dry, equal to 3 pecks and 3 pints.

EPHEBÆUM, in antiquity, the place where the ephebi or youth exerciſed; or, as ſome ſay, where thoſe who deſigned to exerciſe met, and agreed what kind of exerciſe they ſhould contend in, and what ſhould be the victor's reward.

EPHEBI, among the Athenians, a deſignation given to their young men when they arrived at 18 years of age, at which time they had their names entered in a public regiſter.

EPHEDRA, a genus of plants, belonging to the diœcia claſs, and in the natural method ranking under the 51ſt order, *Coniferæ*. See BOTANY *Index*.

EPHEMERA, from ἐφήμερα, "a day;" a diary fever, or a fever of one day's continuance only. In this caſe, ſuch a heat as attends an exceſs of wine, a pulſe ſomewhat full and quick, but ſoft and regular, a ſlight headach, a nauſea, and reſtleſſneſs, are all the ſymptoms, and which terminate without any ſenſible evacuation. If it continue unto the third day, it is not a diary fever; and if the conſtitution is very dry, a hectic is to be dreaded.

EPHEMERA, the *Day-fly*, a genus of inſects belonging to the order of neuroptera. See ENTOMOLOGY *Index*.

EPHEMERIDES, in *Aſtronomy*, tables calculated by aſtronomers, ſhowing the preſent ſtate of the heavens for every day at noon; that is, the places wherein all the planets are found at that time. It is from theſe tables that the eclipſes, conjunctions, and aſpects of the planets, are determined; horoſcopes or celeſtial ſchemes conſtructed, &c. We have ephemerides of Origan, Kepler Argoli, Heckerus, Mezzarachis, Wing, De la Hire, Parker, &c. S. Caſſini has calculated ephemerides of the ſidera medicæa or ſatellites of Jupiter, which are of good uſe in determining the longitude. Epheſus

In England, the Nautical Almanack, or Aſtronomical Ephemeris, publiſhed annually by anticipation, under the direction of the commiſſioners of longitude, is the moſt conſiderable. In France, celeſtial ephemerides have been publiſhed by M. Deſplaces every ten years, from 1715 to 1745; they were afterwards continued by the Abbé Caille, with many additions; of which an account may be ſeen in the Hiſtory of the Academy of Sciences for 1743. The Academy of Sciences have likewiſe publiſhed annually, from the beginning of the preſent century, a kind of ephemeris under the title of *Connoiſſance des Tems*.

EPHESUS, a city of antiquity, much celebrated on account of its temple of Diana, and for being the moſt famous mart or ſtaple town of Hither Aſia. Epheſus was in ancient times the metropolis of all Aſia. Stephanus gives it the title of *Epiphaneſtates*, or *moſt illuſtrious;* and Pliny ſtyles it the ornament of Aſia. The ancient city ſtood about 50 miles ſouth of Smyrna, near the mouth of the river Cayſter, and the ſhore of the Icarian ſea, which is a bay of the Ægæan; but as it has been ſo often deſtroyed and rebuilt, it is no eaſy matter to determine the preciſe place. Moſt of our modern travellers are of opinion, that the ancient city ſtood more to the ſouth than the preſent; which they argue from the ruins that ſtill remain. Epheſus was, in ancient times, known by the names of *Alopes*, *Ortygia*, *Morges*, *Smyrna*, *Trachæa*, *Samornion*, and *Ptelo*. It was called *Epheſus*, according to Heraclides, from the Greek word *epheſis*, ſignifying *permiſſion;* becauſe Hercules (ſays he) permitted the Amazons to live and build a city in that place. Others tell us, that Epheſus was the name of the Amazon that founded the city; for Pliny, Juſtin, and Oroſius, unanimouſly affirm that it was built by an Amazon; while others beſtow this honour upon Androclus, the ſon of Codrus king of Athens, who was the chief of the Ionians that ſettled in Aſia. But in matters of ſo early a date, it is impoſſible to come at the truth, and therefore not worth our while to dwell on ſuch fruitleſs inquiries. What we know for certain is, that the city, which in the Roman times was the metropolis of all Aſia, acknowledged Lyſimachus for its founder; for that prince, having cauſed the ancient city to be entirely demoliſhed, rebuilt, at a vaſt expence, a new one, in a place more convenient, and nearer the temple. Strabo tells us, that, as the inhabitants ſhowed a great reluctance to quit their ancient habitations, Lyſimachus cauſed all the drains that conveyed the water into the neighbouring fens and the Cayſter to be privately ſtopped up; whereby the city being on the firſt violent rains in great part laid under water, and many of the inhabitants drowned, they were glad to abandon the ancient and

retire

Ephesus. retire to the new city. This new Ephesus was greatly damaged by an earthquake in the reign of Tiberius, but by that emperor repaired and adorned with several stately buildings, of which there are now but few ruins to be seen, and scarce any thing worthy of ancient Ephesus. The aqueduct, part of which is still standing, is generally believed to have been the work of the Greek emperors; the pillars which support the arches are of fine marble, and higher or lower as the level of the water required. This aqueduct served to convey water into the city from the spring of Halites, mentioned by Pausanius. The gate, now called by the inhabitants, for what reason we know not, *the Gate of Persecution*, is remarkable for three bas-reliefs on the mould of an exquisite taste. The port, of which so many medals have been struck, is at present but an open road, and not much frequented. The Cayster was formerly navigable, and afforded a safe place for ships to ride in, but is now almost choked up with sand.

But the chief ornament of Ephesus was the temple of Diana, built at the common charge of all the states in Asia, and for its structure, size, and furniture, accounted among the wonders of the world. This great edifice was situated at the foot of a mountain, and at the head of a marsh; which place they chose, if we believe Pliny, as the least subject to earthquakes. This site doubled the charges; for they were obliged to be at a vast expence in making drains to convey the water that came down the hill into the morass and the Cayster. Philo Byzantius tells us, that in this work they used such a quantity of stone, as almost exhausted all the quarries in the country; and these drains or vaults are what the present inhabitants take for a labyrinth. To secure the foundations of the conduits or sewers, which were to bear a building of such a prodigious weight, they laid beds of charcoal, says Pliny, well rammed, and upon them others of wool. Two hundred and twenty years, Pliny says 400, were spent in building this wonderful temple by all Asia. It was 425 feet in length, and 200 in breadth, supported by 127 marble pillars, 70 feet high, of which 27 were most curiously carved, and the rest polished. These pillars were the works of so many kings, and the bas-reliefs of one were done by Scopas, the most famous sculptor of antiquity; the altar was almost wholly the work of Praxiteles. Cheiromocrates, who built the city of Alexandria, and offered to form Mount Athos into a statue of Alexander, was the architect employed on this occasion. The temple enjoyed the privilege of an asylum, which at first extended to a furlong, was afterwards enlarged by Mithridates to a bow-shot, and doubled by Mark Antony, so that it took in part of the city: but Tiberius, to put a stop to the many abuses and disorders that attend privileges of this kind, revoked them all, and declared, that no man guilty of any wicked or dishonest action should escape justice, though he fled to the altar itself.

The priests who officiated in this temple were held in great esteem, and trusted with the care of sacred virgins, or priestesses, but not till they were made eunuchs. They were called *Ephiatores* and *Essenæ*, had a particular diet, and were not allowed by their constitutions to go into any private house. They were maintained with the profits accruing from the lake Selinusis, and another that fell into it, which must have been very considerable, since they erected a golden statue to one Artemidorus, who being sent to Rome, recovered them after they had been seized by the farmers of the public revenues. All the Ionians resorted yearly to Ephesus with their wives and children, where they solemnized the festival of Diana with great pomp and magnificence, making on that occasion rich offerings to the goddess, and valuable presents to her priests. The asiarchæ, mentioned by St Luke, were, according to Beza, those priests whose peculiar province it was to regulate the public sports that were annually performed at Ephesus in honour of Diana: they were maintained with the collections made during the sports; for all Asia flocked to see them. The great Diana of the Ephesians, as she was styled by her blind adorers, was, according to Pliny, a small statue of ebony, made by one Canitia, though commonly believed to have been sent down from heaven by Jupiter. This statue was first placed in a niche, which, as we are told, the Amazons caused to be made in the trunk of an elm. Such was the first rise of the veneration that was paid to Diana in this place. In process of time the veneration for the goddess daily increasing among the inhabitants of Asia, a most stately and magnificent temple was built near the place where the elm stood, and the statue of the goddess placed in it. This was the first temple; but not quite so sumptuous as that which we have described, though reckoned, as well as the second, among the wonders of the world. The second, being that above described, was remaining in Pliny's time, and in Strabo's; and is supposed to have been destroyed in the reign of Constantine, pursuant to the edict by which that emperor commanded all the temples of the heathens to be thrown down and demolished: the former was burnt the same day that Alexander was born, by one Erostratus, who owned on the rack, that the only thing which had prompted him to destroy so excellent a work, was the desire of transmitting his name to future ages. Whereupon the common council of Asia made a decree, forbidding any one to name him; but this prohibition served only to make his name more memorable, such a remarkable extravagance, or rather madness, being taken notice of by all the historians who have written of those times. Alexander offered to rebuild the temple at his own expence, provided the Ephesians would agree to put his name on the front; but they rejected his offer in such a manner as prevented the resentment of that vain prince, telling him, that "it was not fit one god should build a temple to another." The pillars, and other materials that had been saved out of the flames, were sold, and also the jewels of the Ephesian women, who on that occasion willingly parted with them; and the sum raised from thence served for the carrying on of the work till other contributions came in, which in a short time amounted to an immense treasure. This is the temple which Strabo, Pliny, and other Roman writers speak of. It stood between the city and the port, and was built, or rather finished, as Livy tells us, in the reign of King Servius. Of this wonderful structure there is nothing at present remaining but some ruins, and a few broken pillars.

Ephesus.

The Ionians first settled at Ephesus under the conduct of Androclus, who drove out the Carians and Leleges, by whom those places were possessed at his arrival.

Epheſus. rival. The city, whether built by him, as Strabo affirms, or by Crœſus or Epheſus, long before the Ionic migration, as others maintain, became ſoon the metropolis of Ionia. It was at firſt governed by Androclus, and his deſcendants, who aſſumed the royal title, and exerciſed the regal authority over the new colony: whence, even in Strabo's time, the poſterity of Androclus were ſtyled kings, and allowed to wear a ſcarlet robe, with a ſceptre, and all the enſigns of the royal dignity. In proceſs of time, a new form of government was introduced, and a ſenate eſtabliſhed; but when, or on what occaſion, this change happened, we know not. This kind of government continued till the time of Pythagoras, who lived before Cyrus the Great, and was one of the moſt cruel and inhuman tyrants we read of in hiſtory; for having driven out the ſenate, and taken all the power into his own hands, he filled the city with blood and rapine, not ſparing even thoſe who fled to the temple of Diana for ſhelter. Pythagoras was ſucceeded by Pindarus, who bore the ſame ſway in the city; but treated the citizens with more humanity. In his time Epheſus being beſieged by Crœſus king of Lydia, he adviſed the inhabitants to devote their city to Diana, and faſten the wall, by a rope, to the pillars of her temple. They followed his advice, and were, from reverence to the goddeſs, not only treated with great kindneſs by Crœſus, but reſtored to their former liberty. Pindarus being obliged to reſign his power, retired to Peloponneſus. He was, according to Ælian, grandſon to Alyattes king of Lydia, and Crœſus's nephew. The other tyrants of Epheſus mentioned in hiſtory are, Athenagoras, Comes, Ariſtarchus, and Hegeſias; of whom the laſt was expelled by Alexander, who, coming to Epheſus, after having defeated the Perſians on the banks of the Granicus, beſtowed upon Diana all the tributes which the Epheſians had paid to the Perſians, and eſtabliſhed a democracy in the city. In the war between Mithridates and the Romans, they ſided with the former, and, by his directions, maſſacred all the Romans that reſided in their city; for which barbarity they were ſeverely fined, and reduced almoſt to beggary by Sylla, but afterwards treated kindly, and ſuffered to live according to their own laws, as is plain from ſeveral ancient inſcriptions and medals. The Epheſians were much addicted to ſuperſtition, ſorcery, and curious arts, as the ſcripture ſtyles them: whence came the proverb "Epheſian letters," ſignifying all ſorts of ſpells or charms.

In the time of the apoſtle Paul, Epheſus retained a great deal of its ancient grandeur. But it was a ruinous place, when the emperor Juſtinian filled Conſtantinople with its ſtatues, and raiſed his church of St Sophia upon its columns. Since then it has been almoſt quite exhauſted. Towards the end of the 11th century, a Turkiſh pirate, named *Tangripermes*, ſettled there. But the Greek admiral, John Ducas, defeated him in a bloody battle, and purſued the flying Turks up the Meander. In 1306, it was among the places which ſuffered from the exactions of the grand-duke Roger; and two years after, it ſurrendered to Sultan Sayſan, who, to prevent future inſurrections, removed moſt of the inhabitants to Tyriæum, where they were maſſacred. Epheſus appears to have ſubſiſted as an inconſiderable place for ſome time. But now, the Epheſians are only a few Greek peaſants, living in extreme wretchedneſs, dependence, and inſenſibility; the repreſentatives of an illuſtrious people, and inhabiting the wreck of their greatneſs; ſome, the ſubſtructions of the glorious edifices which they raiſed; ſome, beneath the vaults of the ſtadium, once the crowded ſcene of their diverſions; and ſome, by the abrupt precipice, in the ſepulchres which received their aſhes. Ephetæ || Ephraim.

EPHETÆ (from ἐφίημι, "I ſend forth"), in antiquity, a ſort of magiſtrates among the Athenians, inſtituted by King Demophoon, to take cognizance of murder, manſlaughter, and chance-medley.

Their number was 100, whereof 50 were Athenians, and 50 Argians: they were not admitted to the poſt till upwards of 50 years of age. Draco new-modelled it, excluded the Argians out of it, and made it to conſiſt of 51 Athenians, each above 50 years of age: Ubbo Emmius de Rep. Athen. ſays, he transferred to them part of the juriſdiction of the Areopagites. See AREOPAGUS.

EPHOD, in Jewiſh antiquity, one part of the prieſtly habit; being a kind of girdle, which, brought from behind the neck over the two ſhoulders, and hanging down before, was put acroſs the ſtomach, then carried round the waiſt, and made uſe of as a girdle to the tunic.—There were two ſorts of ephods, one of plain linen for the prieſts, and the other embroidered for the high-prieſt.

EPHORI, in Grecian antiquity, magiſtrates eſtabliſhed in ancient Sparta to balance the regal power. The authority of the ephori was very great. They ſometimes expelled and even put to death the kings, and aboliſhed or ſuſpended the power of the other magiſtrates, calling them to account at pleaſure. There were five of them, others ſay nine. They preſided in the public ſhows and feſtivals. They were entruſted with the public treaſure; made war and peace; and were ſo abſolute, that Ariſtotle makes their government equal to the prerogative of a monarchy. They were eſtabliſhed by Lycurgus, according to the generality of authors: though this is denied by others, who date their origin 130 years after the time of that legiſlator. Thus Plutarch, in his Life of Cleomenes, aſcribes their inſtitution to Theopompus king of Sparta; which is alſo confirmed by the authority of Ariſtotle.

EPHORUS, an orator and hiſtorian of Cumæ in Æolia, about 352 years before Chriſt. He was diſciple to Iſocrates, by whoſe advice he wrote a hiſtory which gave an account of all the actions and battles that had happened between the Greeks and barbarians for 750 years. It was greatly eſteemed by the ancients; but is now loſt.

EPHRAIM, in *Ancient Geography*, one of the diviſions of Paleſtine by tribes: Ephraim and the half tribe of Manaſſeh are blended together by the ſacred writer; and it only appears that Ephraim occupied the more ſouthern, and the half tribe of Manaſſeh the more northern parts, but both ſeem to have extended from the Jordan to the ſea. Ephraim alſo denotes a kingdom, on the ſeparation of the 10 tribes from the houſe of David, called alſo the kingdom of Iſrael and of Samaria.

EPHRATA,

Ephrata || Epicedon.

EPHRATA, a small town of Pennsylvania in America, and the principal settlement of the religious sect called *Dunkards* or *Tunkers*. See TUNKERS.

EPHREM, SYRUS, an ancient Christian writer, in the fourth century, deacon of Edessa, was born at Nisibe in Syria. He was greatly esteemed by St Basil, St Gregory, Nyssen, and other great men. He wrote against the opinions of Sabellius, Arius, Apollonarius, the Manichees, &c. and acquired such reputation by his virtue and his works, that he was called the *doctor and the prophet of the Syrians*. He died in 378. The best editions of his works are, that of Oxford, in 1708, in folio, and that of Rome, from 1732 to 1738, in Syriac, Greek, and Latin, 6 vols folio.

EPHYDOR, in antiquity, an officer in the Athenian courts of justice, who was to provide the plaintiff and defendant with equal water hour-glasses. When the glass was run out, they were not permitted to speak any farther; and, therefore, we find them very careful not to lose or mispend one drop of their water. Whilst the laws quoted by them were reciting, or if any other business happened to intervene, they gave orders that the glass should be stopped.

EPIBATÆ, Επιβαται, among the Greeks, marines, or soldiers who served on board the ships of war. They were armed in the same manner as the land-forces, only that more of them wore full or heavy armour.

EPIBATERION, a poetical composition, in use among the ancient Greeks. When any person of condition and quality returned home after a long absence or journey into another country, he called together his friends and fellow-citizens, and made them a speech, or rehearsed them a copy of verses, wherein he returned solemn thanks to the immortal gods for his happy return; and ended with an address by way of compliment to his fellow-citizens.—These verses made what the Greeks call επιβατηριον, *epibaterium*, of επιβαινω, "I go abroad." At going away they had another, called *apobaterium*.

EPIBATERIUM, a genus of plants belonging to the moncecia class. See BOTANY *Index*.

EPIC, or HEROIC, *Poem*, a poem expressed in narration, formed upon a story partly real and partly feigned; representing, in a sublime style, some signal and fortunate action, distinguished by a variety of great events, to form the morals, and affect the mind with the love of heroic virtue.

We may distinguish three parts of the definition, namely, the matter, the form, and the end. The matter includes the action of the fable, under which are ranged the incidents, episodes, characters, morals, and machinery. The form comprehends the way or manner of the narration, whether by the poet himself, or by any persons introduced, whose discourses are related: to this branch likewise belong the moving of the passions, the descriptions, discourses, sentiments, thoughts, style, and versification; and besides these, the similies, tropes, figures, and, in short, all the ornaments and decorations of the poem. The end is to improve our morals and increase our virtue. See POETRY.

EPICEDON (formed of επι *upon*, and κηδος *funeral*), in the Greek and Latin poetry, a poem, or poetical composition, on the death of a person.—At the obsequies of any man of figure, there were three kinds of discourses usually made; that rehearsed at his *bustum* or funeral pile, was called *nenia*; that engraven on his tomb, *epitaph*; and that spoken in the ceremony of his funeral, *epicedion*. We have two beautiful epicedions in Virgil, that of Euryalus and that of Pallas.

Epicedium || Epictetus.

EPICEDIUM, in ancient poetry, a poem rehearsed during the funeral solemnity of persons of distinction.

EPICHARMUS, an ancient poet and philosopher, born in Sicily, was a scholar of Pythagoras. He is said to have introduced comedy at Syracuse in the reign of Hiero. Horace commends Plautus for imitating him, in following the chase of the intrigue so closely as not to give the readers or spectators time to trouble themselves with doubts concerning the discovery. He wrote likewise treatises concerning philosophy and medicine; but none of his works have been preserved. He died aged 90, according to Laertius, who has preserved four verses inscribed on his statue.

EPICHIROTONIA, among the Athenians. It was ordained by Solon, that once every year the laws should be carefully revised and examined; and if any of them were found unsuitable to the present state of affairs, they should be repealed. This was called επιχειροτονια των νομων, from the manner of giving their suffrages by *holding up their hands*. See a farther account of this custom in Pott. Archæol. Græc. lib. 1. cap. 26. tom. i. p. 242.

EPICOENE, in *Grammar*, a term applied to nouns, which, under the same gender and termination, mark indifferently the male and female species. Such in Latin is *aquila*, *vespertilio*, &c. which signify equally a male or female eagle or bat.

Grammarians distinguish between *epicœne* and *common*. A noun is said to be common of two kinds, when it may be joined either with a masculine or a feminine article; and epicœne, when it is always joined to some of the two articles, and yet signifies both genders.

EPICTETUS, a celebrated Stoic philosopher, born at Hierapolis in Phrygia, in the first century, was the slave of Epaphroditus, a freedman and one of Nero's guard. Domitian banishing all philosophers from Rome, about the year 94, Epictetus retired to Nicopolis in Epirus, where he died in a very advanced age; and after his death, the earthen lamp he made use of sold for 3000 drachmas. He was a man of great modesty; which was eminent in his own practice, as well as in his recommendation to others: hence he used to say, "That there is no need of adorning a man's house with rich hangings or paintings, since the most graceful furniture is temperance and modesty, which are lasting ornaments, and will never be the worse for wearing." Of all the ancient philosophers, he seems to have made the nearest approaches to the Christian morality, and to have had the most just ideas of God and providence. He always possessed a cool and serene mind, unruffled by passion; and was used to say, that the whole of moral philosophy was included in these words, *support* and *abstain*. One day, his master Epaphroditus strove in a frolic to wrench his leg; when Epictetus said, with a smile, and free from any emotion, "If you go on, you will certainly break my leg:" but the former redoubling his effort, and striking it with all his strength, he at last broke the bone; when all the return Epictetus made was,

"Did

Epicurean Philoſophy.

"Did not I tell you, Sir, that you would break my leg?" No man was more expert at reducing the rigour of the maxims of the Stoics into practice. He conformed himſelf ſtrictly, both in his diſcourſe and behaviour, to the manners of Socrates and Zeno. He waged continual war with fancy and fortune; and it is an excellence peculiar to himſelf, that he admitted all the ſeverity of the Stoics without their ſourneſs, and reformed Stoiciſm as well as profeſſed it; and beſides his vindicating the immortality of the ſoul as ſtrenuouſly as Socrates or any Stoic of them all, he declared openly againſt ſelf-murder, the lawfulneſs of which was maintained by the reſt of the ſect. Arrian, his diſciple, wrote a large account of his life and death, which is loſt; and preſerved four books of his diſcourſes and his Enchiridion, of which there have been ſeveral editions in Greek and Latin; and, in 1758, a tranſlation of them into Engliſh was publiſhed by the learned and ingenious Miſs Carter.

EPICUREAN PHILOSOPHY, the doctrine or ſyſtem of philoſophy maintained by Epicurus and his followers.

His philoſophy conſiſted of three parts; canonical, phyſical, and ethereal. The firſt was about the canons or rules of judging. The cenſure which Tully paſſes upon him for his deſpiſing logic, will hold true only with regard to the logic of the Stoics, which he could not approve of, as being too full of nicety and quirk. Epicurus was not acquainted with the analytical method of diviſion and argumentation, nor was he ſo curious in modes and formation as the Stoics. Soundneſs and ſimplicity of ſenſe, aſſiſted with ſome natural reflections, was all his art. His ſearch after truth proceeded only by the ſenſes; to the evidence of which he gave ſo great a certainty, that he conſidered them as an infallible rule of truth, and termed them the *firſt natural light of mankind.*

In the ſecond part of this philoſophy he laid down atoms, ſpace, and gravity, as the firſt principles of all things: he did not deny the exiſtence of God, but thought it beneath his majeſty to concern himſelf with human affairs: he held him a bleſſed immortal Being, having no affairs of his own to take care of, and above meddling with thoſe of others.

As to his ethics, he made the ſupreme good of man to conſiſt in pleaſure, and conſequently ſupreme evil in pain. Nature itſelf, ſays he, teaches us this truth; and prompts us from our birth to procure whatever gives us pleaſure, and avoid what gives us pain. To this end he propoſes a remedy againſt the ſharpneſs of pain: this was to divert the mind from it, by turning our whole attention upon the pleaſures we have formerly enjoyed. He held that the wiſe man muſt be happy as long as he is wiſe; the pain, not depriving him of his wiſdom, cannot deprive him of his happineſs.

There is nothing that has a fairer ſhow of honeſty than the moral doctrine of Epicurus. Gaſſendus pretends, that the pleaſure in which this philoſopher has fixed the ſovereign good, was nothing elſe but the higheſt tranquillity of mind, in conjunction with the moſt perfect health of body: but Tully, Horace, and Plutarch, as well as almoſt all the fathers of the church, give us a very different account of it: indeed the nature of this pleaſure, in which the chief happineſs is ſuppoſed to be ſeated, is a grand problem in the morals of Epicurus. Hence there were two kinds of Epicureans, the rigid and the remiſs: the firſt were thoſe who underſtood Epicurus's notion of pleaſure in the beſt ſenſe, and placed all their happineſs in the pure pleaſures of the mind, reſulting from the practice of virtue: the looſe or remiſs Epicureans, taking the words of that philoſopher in a groſs ſenſe, placed all their happineſs in bodily pleaſures or debauchery. Epicurus II Epidaurus.

EPICURUS, the greateſt philoſopher of his age, was born at Gargettium in Attica, about 340 B. C. in the 109th Olympiad. He ſettled at Athens in a fine garden he had bought; where he lived with his friends in great tranquillity, and educated a great number of diſciples. They lived all in common with their maſter. The reſpect which his followers paid to his memory is admirable: his ſchool was never divided, but his doctrine was followed as an oracle. His birth-day was ſtill kept in Pliny's time; the month he was born in was obſerved as a continual feſtival; and they placed his picture everywhere. He wrote a great many books, and valued himſelf upon making no quotations. He raiſed the atomical ſyſtem to a great reputation, though he was not the inventor of it, but had only made ſome change in that of Democritus. As to his doctrine concerning the ſupreme good or happineſs, it was very liable to be miſrepreſented, and ſome ill effects proceeded from thence, which diſcredited his ſect. He was charged with perverting the worſhip of the gods, and inciting men to debauchery; but he did not forget himſelf on this occaſion; he publiſhed his opinions to the whole world; he wrote ſome books of devotion; recommended the veneration of the gods, ſobriety, and chaſtity; and it is certain that he lived in an exemplary manner, and conformably to the rules of philoſophical wiſdom and frugality. Timocrites, a deſerter of his ſect, ſpoke very ſcandalouſly of him. Gaſſendus has given us all he could collect from the ancients concerning the perſon and doctrine of this philoſopher; who died of a ſuppreſſion of urine, aged 72.

EPICYCLE, in the ancient aſtronomy, a little circle whoſe centre is in the circumference of a greater circle: or it is a ſmall orb or ſphere, which being fixed in the deferent of a planet, is carried along with it; and yet, by his own peculiar motion, carries the planet faſtened to it round its proper centre.

It was by means of epicycles that Ptolemy and his followers ſolved the various phenomena of the planets, but more eſpecially their ſtations and retrogradations.

EPICYCLOID, in *Geometry*, a curve generated by the revolution of the periphery of a circle, along the convex or concave ſide of the periphery of another circle.

EPICYEMA, among *Phyſicians*, denotes a ſuperfetation; being a falſe conception or mole happening after the birth of a regular fœtus.

EPIDAURUM, EPIDAURUS, or EPITAURUM, in *Ancient Geography*, a town of Dalmatia, on the Adriatic, built the ſame year, as is ſaid, with Dyrrachium, 430 years after the deſtruction of Troy: a conſiderable town formerly, but now reduced to a ſmall village, called *Raguſi Vecchio*; diſtant ſix miles from the modern Raguſi. E. Long. 19°. Lat. 42°. 20′.

EPIDAURUS, in *Ancient Geography*, a town of

Epidaurus. Argolis, in Peloponnesus, on the Saronic bay, to the south of the promontory *Spiræum*; called *sacred*, because of the religious veneration paid to Æsculapius, whose temple stood at the distance of five miles from the town. The Romans, during a pestilence, being advised to convey the god to Rome, sent a ship, with a solemn embassy, for his conveyance; but while the Epidaurians were in suspense to part with him, a huge serpent sailed to the ship; and being taken for the god, was carried to Rome in great solemnity. Epidaurus stood in a recess of the bay, fronting the east; and was fortified by nature, being inclosed by high mountains reaching to the sea, and rendering it difficult of access. It had several temples, and in the acropolis or citadel was a remarkable statue of Minerva. The site is now called *Epi-thavro*. The traces are indistinct, and it has probably been long deserted. The harbour of Epidaurus is long. Its periplus or circuit was 15 stadia or near two miles. The entrance is between mountains, and on a small rocky peninsula on the left hand are ruins of a modern fortress. This, it seems, was the point on which a temple of Juno stood. It is frequented by vessels for wood or corn. The grove of Æsculapius was inclosed by mountains, within which all the sacrifices as well of the Epidaurians as of strangers were consumed. One was called Titthion; and on this the god when an infant was said to have been exposed, and to have been suckled by a she-goat. He was a great physician, and his temple was always crowded with a sick persons. Beyond it was the dormitory of the suppliants; and near it, a circular edifice called the *Tholus*, built by Polycletus, of white marble, worth seeing. The grove, besides other temples, was adorned with a portico, and a fountain remarkable for its roof and decorations. The bath of Æsculapius was one of the benefactions of Antoninus Pius, while a Roman senator; as was also a house for the reception of pregnant women and dying persons, who before were removed out of the inclosure, to be delivered or to expire in the open air. The remains are heaps of stones, pieces of brick wall, and scattered fragments of marble; besides some churches or rather piles of rubbish miscalled, being destitute of doors, roofs, or any kind of ornament. The statue of Æsculapius was half as big as that of Jupiter Olympius at Athens. It was made of ivory and gold, and, as the inscription proved, by Thrasymedes son of Arignotus of Paros. He was represented sitting, holding his staff, with one hand on the head of a serpent, and a dog lying by him. Two Argive heroes, Bellerophon combating with the monster Chimæra, and Perseus severing the head of Medusa, were carved on the throne. Many tablets described the cures performed by the deity, yet he had not escaped contumely and robbery. Dionysius deprived him of his golden beard, affirming that it was unseemly in him to appear in that manner when his father Apollo was always seen with his face smooth. Sylla amassed the precious offerings belonging to him and to Apollo and Jupiter at Delphi and Olympia, to pay his army before Athens. The marks in the walls testified that a great number had been plucked down. A few fragments of white marble exquisitely carved occur in the heap of the temple. The inclosure of the temple once abounded in inscriptions. In the second century six marbles remained, on which were written in the Doric dialect the names of men and women who had been patients of the god, with the distemper each had laboured under, and the remedies he had directed. Dr Chandler found only a couple of votive inscriptions, and two pedestals of statues, one of which represented a Roman, and was erected by the city of the Epidaurians. The stadium was near the temple. It was of earth, as most in Greece were. At the upper end are seats of stone, but these were continued along the sides only a few yards. A vaulted passage leading underneath into the area, now choked up, was a private way by which the Agonothetæ or presidents with the priests and persons of distinction entered. Two large cisterns or reservoirs remain, made by Antoninus for the reception of rain water. Beyond them is a dry watercourse; and in the mountain-side on the right hand are the marble seats of the theatre, overgrown with bushes. The springs and wells by the ruins are now supposed to possess many excellent properties. To these and a good air, Dr Chandler thinks, with the recreations of the theatre and of the stadium, and to the medicinal knowledge and experience of the priests, may be attributed both the recovery of the sick and the reputation of Æsculapius. Epidaurus || Epidotæ.

EPIDAURUS, with the surname *Limera*, to distinguish it from the Epidaurus of Argolis; called so, either from its meadows or its commodious harbours (Stephanus, Apollodorus): a town of Laconia, on the Ionian sea, to the south of the Sinus Argolicus, situated where now Molvasia stands, in the Morea. E. Long. 23. 30. Lat. 35. 40.

EPIDEMIA, in Grecian antiquity, festivals kept in honour of Apollo and Diana, at the stated seasons, when those deities, who could not be present everywhere, were supposed to visit different places, in order to receive the vows of their adorers.

EPIDEMIC, among physicians, an epithet of diseases which at certain times are popular, attacking great numbers at or near the same time.

EPIDENDRUM, a genus of plants, belonging to the gynandria class; and in the natural method ranking under the seventh order, *Orchideæ*. See BOTANY *Index*.—This is the plant which produces the fruit called *vanilla*, and which is used in perfuming chocolate, tobacco, and snuff.

EPIDERMIS, in *Anatomy*, the cuticle or scarf-skin. See ANATOMY *Index*. The word is formed of the Greek επι, *on, over*; and δερμα, *skin*.

EPIDICASIA, among the Athenians. Daughters inheriting their parents estate were obliged to marry their nearest relation; which gave occasion to persons of the same family to go to law with one another, each pretending to be more nearly allied to the heiress than the rest. The suit was called επιδικασιας δικη: and the virgin, about whom the relations contested, επιδικος.

EPIDIDYMIS, in *Anatomy*, a little round body, on the back of each testicle; called also *parastata*. See ANATOMY *Index*.

EPIGÆA, a genus of plants, belonging to the decandria class; and in the natural method ranking under the 18th order, *Bicornes*. See BOTANY *Index*.

EPIDOTÆ, certain deities who presided over the growth

Epigaſtric growth of children. They were worſhipped by the Lacedæmonians, and chiefly invoked by thoſe who were perſecuted by the ghoſts of the dead, &c.

EPIGASTRIC REGION, a part or ſubdiviſion of the abdomen. See ANATOMY *Index*.

EPIGLOTTIS, in *Anatomy*, one of the cartilages of the larynx or wind-pipe. See ANATOMY *Index*.

EPIGONI, the ſons and deſcendants of the Grecian heroes who were killed in the firſt Theban war. The war of the Epigoni is famous in ancient hiſtory. It was undertaken ten years after the firſt. The ſons of thoſe who had periſhed in the firſt war, reſolved to avenge the death of their fathers, and marched againſt Thebes, under the command of Theriander; or, according to others, of Alcmæon the ſon of Amphiaraus, about 1307 years before Chriſt. The Argives were aſſiſted by the Corinthians, the people of Meſſenia, Arcadia, and Megara. The Thebans had engaged all their neighbours in their quarrel, as in one common cauſe. Theſe two hoſtile armies met and engaged on the banks of the Gliſſas. The fight was obſtinate and bloody, but victory declared for the Epigoni, and ſome of the Thebans fled to Illyricum with Leodamas their general, while others retired into Thebes, where they were ſoon beſieged, and forced to ſurrender. In this war Ægialeus was the only one who was killed, and his father Adraſtus was the only one who eſcaped alive in the firſt war. This whole war, as Pauſanias obſerves, was written in verſe; and Callinus, who quotes ſome of the verſes, aſcribes them to Homer, which opinion has been adopted by many writers. "For my part (continues the geographer), I own, that next to the Iliad and Odyſſey of Homer, I have never ſeen a finer poem." The deſcendants of the veteran Macedonians, who ſerved under Alexander the Great, and who had children by Aſiatic women, were alſo called *Epigoni*, (Juſtin.)

EPIGRAM, in *Poetry*, a ſhort poem in verſe, treating only of one thing, and ending with ſome lively, ingenious, and natural thought or point. The word is formed of επιγραμμα *inſcription*, of επιγραφειν *to inſcribe* or *write upon*.

Epigrams then, originally ſignify inſcriptions, and they derive their origin from thoſe inſcriptions placed by the ancients on their tombs, ſtatues, temples, triumphal arches, &c. Theſe, at firſt, were only ſimple monograms: afterwards, increaſing their length, they made them in verſe, to be the more eaſily retained: Herodotus and others have tranſmitted to us ſeveral of them. Such little poems retained the name of epigrams, even after the deſign of their firſt inſtitution was varied, and people began to uſe them for the relation of little facts and accidents, the characterizing of perſons, &c. The point or turn is a quality much inſiſted on by the critics, who require the epigram conſtantly to cloſe with ſomething poignant and unexpected, to which all the reſt of the compoſition is only preparatory; while others, on the contrary, exclude the point, and require the thought to be equally diffuſed throughout the poem, without laying the whole ſtreſs on the cloſe: the former is uſually Martial's practice, and the latter that of Catullus.

The Greek epigrams have ſcarce any thing of the point or briſkneſs of the Latin one: thoſe collected in the Anthology have moſt of them a remarkable air of eaſe and ſimplicity, attended with ſomething juſt and witty; ſuch as we find in a ſenſible peaſant, or a child that has wit. They have nothing that bites, but ſomething that tickles. Though they want the ſalt of Martial, yet to a good taſte they are not inſipid; except a few of them, which are quite flat and ſpiritleſs. However, the general faintneſs and delicacy of the pleaſantry in them has given occaſion for a Greek epigram, or *epigram à la Greque*, to denote, among the French, an epigram void of ſalt or ſharpneſs.

Epigaſtric || Epigram.

Epigraph: || Epimenides

The epigram admits of great variety of ſubjects: ſome are made to praiſe, and others to ſatirize; which laſt are much the eaſieſt, ill-nature ſerving inſtead of point and wit. Boileau's epigrams are all ſatires on one or another; thoſe of Des Reaux are all made in honour of his friends; and thoſe of Mad. Scudery are ſo many eloges. The epigram being only a ſingle thought, it would be ridiculous to expreſs it in a great number of verſes.

EPIGRAPHE, among antiquarians, denotes the inſcription of a building, pointing out the time when, the perſons by whom, the uſes, and the like, for which it was erected.

EPILEPSY, in *Medicine*, the ſame with what is otherwiſe called the *falling-ſickneſs*, from the patient's falling ſuddenly to the ground. See MEDICINE *Index*.

EPILOBIUM, the WILLOW HERB. A genus of plants, belonging to the octandria claſs; and in the natural method ranking under the 17th order, *Calycanthemæ*. See BOTANY *Index*.

EPILOGUE, in *Oratory*, the end or concluſion of a diſcourſe, ordinarily containing a recapitulation of the principal matters delivered.

EPILOGUE, in dramatic poetry, a ſpeech addreſſed to the audience, after the play is over, by one of the principal actors therein; uſually containing ſome reflections on certain incidents in the play, eſpecially thoſe in the part of the perſon that ſpeaks it; and having ſomewhat of pleaſantry, intended to compoſe the paſſions raiſed in the courſe of the repreſentation: A practice which is ridiculed by the *Spectator*; and compared to a merry jigg upon the organ after a good ſermon, to wipe away any impreſſions that might have been made thereby, and ſend the people away juſt as they came.

EPIMEDIUM, BARREN-WORT. A genus of plants, belonging to the tetrandria claſs; and in the natural method ranking under the 24th order, *Corydales*. See BOTANY *Index*.

EPIMENIDES, an ancient poet and philoſopher, was born at Gnoſſus in Crete. Contrary to the cuſtom of his country, he always wore his hair long; which, according to ſome, was becauſe he was aſhamed of being thought a Cretan: and indeed he does not ſeem to have had a high opinion of his countrymen, if that verſe cited by St Paul be, as it is generally believed to be, his; "The Cretans are always liars, evil beaſts, ſlow bellies." Many ſtories are related of him, too wonderful to merit attention; however, his reputation was ſo great over all Greece, that he was there eſteemed a favourite of the gods. The Athenians being afflicted with the plague, and commanded by the oracle to make a ſolemn luſtration of the city, ſent Nicias, the ſon of Niceratus, with a ſhip to Crete, to deſire Epimenides to come to them. He accepted their in-

Epimetheus, Epiphanius.

vitation, accompanied the meſſengers to Athens, performed the luſtration of the city, and the plague ceaſed. Here he contracted an acquaintance with Solon, whom he privately inſtructed in the proper methods for the regulation of the Athenian commonwealth. Having finiſhed his buſineſs at Athens, the citizens offered him many valuable preſents and high honours, and appointed a ſhip to carry him back to Crete; but he returned their preſents, and would accept of nothing except a little branch of the ſacred olive preſerved in the citadel; and deſired the Athenians to enter into an alliance with the Gnoſſians. Having obtained this, he returned to Crete; where he died ſoon after, aged 157 years; or as the Cretans, conſiſtently with their character, pretended, 299. He was a great poet, and wrote 5000 verſes on "the genealogy of the gods," 6500 "on the building of the ſhip Argos and Jaſon's expedition to Colchis," and 4000 "concerning Minos and Rhadamanthus." He wrote alſo in proſe, "Concerning ſacrifices and the commonwealth of Crete." St Jerome likewiſe mentions his "book of oracles and reſponſes." The Lacedemonians procured his body, and preſerved it among them by the advice of an oracle; and Plutarch tells us, that he was reckoned the ſeventh wiſe man by thoſe who refuſed to admit Periander into the number.

EPIMETHEUS, a ſon of Japetus and Clymene, one of the Oceanides, who inconſiderately married Pandora, by whom he had Pyrrha, the wife of Deucalion. He had the curioſity to open the box which Pandora had brought with her, and from thence iſſued a train of evils, which from that moment have never ceaſed to afflict the human race. Hope was the only one which remained at the bottom of the box, not having a ſufficient time to eſcape, and it is ſhe alone which comforts men under misfortunes. Epimetheus was changed into a monkey by the gods, and ſent into the iſland Pithecuſa.

EPIPHANIUS (St), an ancient father of the church, born at Beſanducan, a village in Paleſtine, about the year 332. He founded a monaſtery near the place of his birth, and preſided over it. He was afterwards elected biſhop of Salamis; when he ſided with Paulinus againſt Meletius, and ordained in Paleſtine Paulinian the brother of St Jerome; on which a conteſt aroſe between him and John biſhop of Jeruſalem. He afterwards called a council in the iſland of Cyprus, in which he procured a prohibition of the reading of Origen's writings; and made uſe of all his endeavours to prevail on Theophilus biſhop of Alexandria to engage St Chryſoſtom to declare in favour of that decree: but not meeting with ſucceſs, he went himſelf to Conſtantinople, where he would not have any converſation with St Chryſoſtom; and formed the deſign of entering the church of the apoſtles to publiſh his condemnation of Origen; but being informed of the danger to which he would be expoſed, he reſolved to return to Cyprus; but died at ſea in the year 403. His works were printed in Greek, at Baſil, 1544, in folio; and were afterwards tranſlated into Latin, in which language they have been often reprinted. Petavius reviſed and corrected the Greek text by two manuſcripts, and publiſhed it together with a new tranſlation at Paris in 1622. This edition was reprinted at Cologne in 1682.

Epiphany || Epirus.

EPIPHANY, a Chriſtian feſtival, otherwiſe called the *Manifeſtation of Chriſt to the Gentiles*, obſerved on the ſixth of January, in honour of the appearance of our Saviour to the three magi or wiſe men, who came to adore him and bring him preſents. The feaſt of epiphany was not originally a diſtinct feſtival; but made a part of that of the nativity of Chriſt, which being celebrated 12 days, the firſt and laſt of which were high or chief days of ſolemnity, either of theſe might properly be called *epiphany*, as that word ſignifies the appearance of Chriſt in the world.

The word in the original Greek, επιφανια, ſignifies *appearance* or *apparition*; and was applied, as ſome critics will have it, to this feaſt, on account of the ſtar which appeared to the magi.—St Jerome and St Chryſoſtom take the epiphany for the day of our Saviour's baptiſm, when he was declared to men by the voice, *Hic eſt filius meus dilectus, in quo mihi complacui*: "This is my beloved Son, in whom I am well pleaſed." And accordingly it is ſtill obſerved by the Cophtæ and Ethiopians in that view. Others contend, that the feaſt of Chriſtmas, or the nativity of our Saviour, was held in divers churches on this day; which had the denomination *epiphany*, or *appearance*, by reaſon of our Saviour's firſt appearance on earth at that time. And it muſt be allowed, that the word is uſed among the ancient Greek fathers, not for the appearance of the ſtar to the magi, but for that of our Saviour to the world: In which ſenſe St Paul uſes the word *epiphania* in his ſecond epiſtle to Timothy, i. 10.

EPIPHONEMA. See ORATORY, n° 96.

EPIPHORA, in *Medicine*, a preternatural defluxion of the eyes, when they continually diſcharge a ſharp ſerous humour, which excoriates the cheeks. See MEDICINE *Index*.

EPIPHYSIS, in *Anatomy*. See ANATOMY *Index*.

EPIPLOCELE, in *Medicine*, is a kind of hernia or rupture, in which the omentum ſubſides into the ſcrotum.

EPIPLOOMPHALON, in *Medicine*, an hernia umbilicalis, proceeding from the omentum falling into the region of the umbilicus or navel.

EPIPLOON. See OMENTUM, ANATOMY *Index*.

EPIRUS, a diſtrict of ancient Greece, bounded on the eaſt by Etolia, on the weſt by the Adriatic, on the north by Theſſaly and Macedon, and on the ſouth by the Ionian ſea. This country was anciently governed by its own princes, in which ſtate it made a very conſiderable figure. The country, according to Joſephus, was firſt peopled by Dodanim the ſon of Javan and grandſon of Japhet. The people were very warlike; but they continued in their ſavage ſtate long after their neighbours were civilized; whence the iſlanders uſed to threaten their offenders with tranſportation to Epirus. Their horſes were in great requeſt among the ancients, as well as the dogs produced in one of the diviſions called *Moloſſus*; and hence theſe dogs were called by the Romans *Moloſſi*.

The hiſtory of Epirus commences with the reign of Pyrrhus the ſon of Achilles by Deidamia the daughter of Lycomedes king of Scyros. He is ſaid to have behaved with great bravery at the ſiege of Troy; but it would appear that he behaved with no leſs barbarity. After the city was taken, he is ſaid to have killed old king Priam with his own hand; to have thrown Aſtyanax the ſon

of

Epirus.

of Hector and Andromache headlong from a high tower; and sacrificed Polyxena the daughter of Priam on the tomb of his father. He carried Andromache with him into Epirus, where he settled by the advice of the famous soothsayer Helenus, one of Priam's sons, who had served during the Trojan war both under his father and himself. The only remarkable period of the history of Epirus is the reign of Pyrrhus II. who made war upon the Romans. He was invited into Italy by the Tarentines; and embarked about 280 B. C. After having escaped many dangers by sea, he landed in that country, and with great difficulty gained a victory over the Romans; but he was afterwards utterly defeated by them †, and obliged to return into his own own country. To retrieve his honour, he then undertook an expedition against Macedon; where he overthrew Antigonus, and at last made himself master of the whole kingdom. He then formed a design of subduing all the other Grecian states; but met with such an obstinate resistance at Lacedæmon, that he was obliged to drop the enterprise; and was soon after killed at the siege of Argos by a woman, who from the wall threw a tile upon his head. Deidamia, the grand-daughter of Pyrrhus, was the last that sat on the throne of Epirus. She is said to have been murdered after a short reign; upon which the Epirots formed themselves into a republic.

† See *Rome*.

Under the new form of government Epirus never made any considerable figure, but seems rather to have been dependent on the kingdom of Macedon. The Romans having conquered Philip king of that country, restored the Epirots to their ancient liberty; but they, forgetful of this favour, soon after took up arms in favour of Perseus. As a punishment for this ingratitude, the Romans gave orders to Paulus Emilius, after the reduction of Macedon, to plunder the cities of Epirus, and level them with the ground. This was punctually executed throughout the whole country on the same day and at the same hour. The booty was sold, and each foot-soldier had 200 denarii, that is, six pounds nine shillings and two pence, and each of the horse the double of this sum. An hundred and fifty thousand men were made slaves, and sold to the best bidder for the benefit of the republic. Nor did the vengeance of Rome stop here; all the cities of Epirus, to the number of 70, were dismantled, and the chief men of the country carried to Rome, where they were tried, and most of them condemned to perpetual imprisonment. After this terrible blow, Epirus never recovered its ancient splendor. Upon the dissolution of the Achæan league, it was made part of the province of Macedon; but when Macedon became a diocese, Epirus was made a province of itself, called the province of *Old Epirus*, to distinguish it from *New Epirus*, another province lying to the east of it. On the division of the empire, it fell to the emperors of the east, and continued under them till the taking of Constantinople by the Latins, when Michael Angelus, a prince nearly related to the Greek emperor, seized on Etolia and Epirus, of which he declared himself despot or prince; and was succeeded by his brother Theodorus, who took several towns from the Latins, and so far enlarged his dominions, that, disdaining the title of *despot*, he assumed that of *emperor*, and was crowned by Demetrius archbishop of Bulgaria. Charles, the last prince of this family, dying without lawful issue, bequeathed Epirus and Acarnania to his natural sons, who were driven out by Amurath the second. Great part of Epirus was afterwards held by the noble family of the Castriots; who, though they were masters of all Albania, yet styled themselves princes of Epirus. Upon the death of the famous George Castriot, surnamed *Scanderbeg*, Epirus fell to the Venetians, who were soon dispossessed of it by the Turks; in whose hands it still continues, being now known by the name of *Albania*, which comprehends the Albania of the ancients, all Epirus, and that part of Dalmatia which is subject to the Turks.

Episcopacy.

EPISCOPACY, that form of church-government, in which diocesan bishops are established as distinct from and superior to priests or presbyters. We have already observed, that it is a long time since the ministers of religion have been distinguished into different orders, and that it has been much controverted whether the distinction be of divine or human right; whether it was settled in the apostolic age or afterwards. (See BISHOP.) This controversy commenced soon after the Reformation; and has been agitated with great warmth between the *Episcopalians* on the one side, and the *Presbyterians* and *Independents* on the other. Among the Protestant churches *abroad*, those which were reformed by *Luther* and his associates are in general *episcopal*; whilst such as follow the doctrines of *Calvin* have for the most part thrown off the order of bishops as one of the corruptions of popery. In *England*, however, the controversy has been considered as of greater importance than on the *Continent*; for it has there been strenuously maintained by one party, that the *episcopal order* is essential to the constitution of the church; and by others, that it is a pernicious encroachment on the rights of men, for which there is no authority in scripture. Though the question has for some time lain almost dormant, and though we have no desire to revive it; yet as a work of this kind might perhaps be deemed defective, did it contain no account whatever of a controversy which has employed some of the ablest writers of the past and present centuries, we shall give a fair though short view of the chief arguments by which the advocates of each contending party have endeavoured to support their own cause, leaving our readers to judge for themselves where the truth lies. See INDEPENDENTS and PRESBYTERIANS.

1 Commencement of the episcopal controversy.

The *Independent* maintains, that under the gospel dispensation there is nothing which bears the smallest resemblance to an exclusive priesthood; that Christ and his apostles constituted no permanent order of ministers in the church; but that any man who has a firm belief in revelation, a principle of sincere and unaffected piety, a capacity for leading devotion and communicating instruction, and a serious inclination to engage in the important employment of promoting the everlasting salvation of mankind; is to all intents and purposes a regular minister of the New Testament, especially if he have an invitation to the pastoral office from some particular society of Christians.

2 The Independent scheme.

Against this scheme, which supposes the rights of Christians all equal and common, and acknowledges no authority in the church except what may be derived from the election of her members, the Protestant Episcopalian reasons in the following manner. He admits, as an undoubted truth, that our blessed Lord gave to none

3 Episcopal arguments against it.

Epiſcopacy. none of his immediate followers authority or juriſdiction of ſuch a nature as could interfere with the rights of the civil magiſtrate, for all ſuch authority was diſclaimed by himſelf: "My kingdom (ſaid he to Pilate) is not of this world:" and to a certain perſon who aſked him to decide a queſtion of property between him and his brother, he replied, "Man, who made me a judge or a divider over you." But when it is conſidered, that Chriſt came into this world to "turn men from darkneſs to light, and from the power of Satan to the living God; that he gave himſelf for us, that he might redeem us from all iniquity, and purify to himſelf a peculiar people zealous of *good works;* that of theſe works many are ſuch as unregenerate humanity has no inclination to perform, and that the doctrines which he revealed are ſuch as human reaſon could never have diſcovered; the advocate for epiſcopacy thinks it was extremely expedient, if not abſolutely neceſſary; that, when he aſcended into heaven, he ſhould eſtabliſh upon earth ſome authority to illuſtrate the revelation which he had given, and to enforce obedience to the laws which he had enacted. There is nothing, continues he, more ſtrictly required of Chriſtians, than that they live together in unity, profeſſing the ſame faith, joining in the ſame worſhip, and practiſing the ſame virtues. But as men have very different paſſions, prejudices, and purſuits, ſuch unity would be impoſſible, were they not linked together in *one ſociety* under the government of perſons authoriſed to watch over the purity of the faith, to preſcribe the forms of public worſhip, and to explain the nature, and inculcate the neceſſity of the ſeveral virtues. The ſociety of Chriſtians, in reſpect of its unity and organization, is compared to the human body: for "as we have many members in one body, and all members have not the ſame office; ſo we being many are one body in Chriſt, and every one members one of another," (Rom. xii. 4, 5.) It is called the *church*, the *kingdom of heaven*, and *the kingdom of God;* and its affairs, like thoſe of every other kingdom, are adminiſtered by proper officers in ſubordination to the ONE LORD, who, "when he aſcended up on high, and led captivity captive, gave ſome apoſtles, and ſome prophets, and ſome paſtors and teachers, for the perfecting of the ſaints, for the work of the miniſtry, for the edifying of the body of Chriſt:" (Epheſ. iv. 8—13.) That thoſe various orders of miniſters were veſted with real authority in the church might be inferred from principles of reaſon as well as from the dictates of revelation. A ſociety without ſome ſort of government, government without laws, or laws without an executive power, is a direct abſurdity. Where there are laws, ſome muſt govern, and others be governed; ſome muſt command, and others obey; ſome muſt direct, and others ſubmit to direction. This is the voice of *nature;* it is likewiſe the language of *ſcripture.* "Obey them (ſays the inſpired author of the epiſtle to the Hebrews) who have the rule over you, and ſubmit yourſelves; for they watch for your ſouls as they that muſt give account." A text which ſhows that the authority of the miniſters of religion was diſtinct from that of the civil magiſtrate, whoſe duty is to watch, *not for the ſouls*, but for the *lives* and *properties*, of his ſubjects.

4 Chriſtians linked together in one ſociety called the *church*, the *kingdom of heaven*, and the *kingdom of God.*

5 The church governed by proper officers.

Of the ſociety thus conſtituted, it was not, as of a philoſophical ſect, left to every man's *choice* whether or not he would become a member. All who embrace the faith of the Redeemer of the world are required to be *baptiſed*, under the pain of forfeiting the benefits of redemption: but one great purpoſe for which baptiſm was inſtituted, is to be the rite of initiation into the church of Chriſt; "for by one ſpirit are we all baptized into one body, whether we be Jews or Gentiles, whether we be bond or free," (1 Cor. xii. 13.). Of baptiſm, whatever be the importance, it is evident, that to receive it, is not, like the practice of juſtice, or the veneration of the Supreme Being, a duty reſulting from the relations of man to his Creator and fellow-creatures; that its whole efficacy, which in ſcripture is ſaid to be nothing leſs than the remiſſion of ſins, is derived from *poſitive inſtitution;* and therefore, that the *external rite* can be of no avail, but when it is adminiſtered in the *manner preſcribed*, and by a perſon *authoriſed* to adminiſter it. That *all* Chriſtians are not veſted with this authority, as one of the common privileges of the faith, appears from the commiſſion which our Saviour after his reſurrection gave to his apoſtles. At that period, we are aſſured that the number of his followers was not leſs than *five hundred;* yet we find, that to the *eleven diſciples* only did "he come and ſpeak, ſaying, All power is given unto me in heaven and in earth; go ye, therefore, and teach all nations, baptizing them in the name of the Father, and of the Son, and of the Holy Ghoſt."

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6 All Chriſtians required to be members of the church.

7 All Chriſtians not authoriſed to adminiſter the ſacraments.

Of the 500 diſciples there is ſurely no reaſon to believe that there were not *many* well qualified to inſtruct either a Jew or a Gentile in the doctrines of the goſpel; and it is certain, that *any one* of them could have waſhed his convert with water in the name of the Holy Trinity as well as St Peter or St John: but ſuch an unauthoriſed waſhing would not have been Chriſtian baptiſm, nor of equal validity with it, any more than the opinion of a lawyer at the bar is the judgment of a court of juſtice, or of equal obligation. It is the commiſſion of the ſovereign which gives force to the judgment of the court; it is the commiſſion of Chriſt which gives validity to baptiſm. The ſame reaſoning is applicable to the Lord's ſupper, which, if it be not adminiſtered by thoſe who have authority for ſuch adminiſtration, cannot be deemed a ſacrament of Chriſt's inſtitution.

Theſe two rites are the external badges of our profeſſion. By the *one*, we are incorporated into that ſociety of which our Redeemer is the head and ſovereign: in the celebration of the *other*, we have a right to join, whilſt of that ſociety we continue members. But if by an open and ſcandalous diſregard of the precepts of the goſpel, we ſhould prove ourſelves unworthy of its privileges, the ſame perſons who are authoriſed to admit us into the church, are likewiſe veſted with authority to caſt us out of it: for to them were given "the keys of the kingdom of heaven (or the church), with aſſurance, that whatſoever they ſhould bind on earth, ſhould be bound in heaven; and whatſoever they ſhould looſe on earth, ſhould be looſed in heaven," (Mat. xviii. 18.) As baptiſm is to be adminiſtered ſo long as there ſhall be perſons to be enliſted under the banners of Chriſt, and the Lord's Supper to be celebrated ſo long as it ſhall be the duty of ſoldiers to adhere to the ſtandard of their leader and their head; and as it is likewiſe to be feared that there will never come a time when

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when all Christians shall "walk worthy of the vocation wherewith they are called;" it follows, that this *power of keys*, which was originally given to the apostles, must continue in the church through all ages, even unto the end of the world. But as we have seen, that it was not at first intrusted to *all* the disciples in common, as one of the privileges inseparable from their profession, and as no body of men can possibly *transfer* an authority of which they themselves were *never possessed*; it is certain, that even now it cannot, by the election of one class of Christians, be delegated to another, but must, by some mode of succession, be derived from the apostles, who were sent by Christ as he was sent by his Father. To argue from the origin of *civil* to that of *ecclesiastical* government, although not very uncommon, the Episcopalian deems extremely fallacious. Of the various nations of the world, many of the sovereigns may indeed derive their authority from the suffrages of their subjects; because in a state of nature every man has an inherent right to defend his life, liberty and property; and what he possesses in his own person, he may for the good of society transfer to another: but no man is by *nature*, or can *make himself*, a member of the Christian church; and therefore authority to govern that society can be derived only from him by whom it was founded, and who died that he might "gather together in one all the children of God."

5 Christians as a body cannot transfer to one of their number an authority of which they were never possessed.

9 Authority to govern the church can be derived only from Christ.

Against such reasoning as this it hath been urged, that to make institutions, which like baptism and the Lord's supper are generally necessary to the salvation of *all* Christians, depend for their efficacy upon the authority or commission of a *particular order*, appears inconsistent with the wisdom and goodness of God; as by such an economy an intolerable domination would be established over the souls of men, and the purpose for which the Saviour of the world died might be in some degree defeated by the caprice of an ignorant and arbitrary priesthood. The objection is certainly plausible; but the Episcopalian affirms, that either it has no weight, or militates with equal force against the wisdom of Providence in the government of this world.—In every thing, he observes, relating to their temporal and to their spiritual interests, mankind are all subjected to mutual dependence. The rich depend upon the poor, and the poor upon the rich. An infant neglected from the birth would barely cry and cease to live; nor is it easily to be conceived, that in the more rigid climates of the earth a full grown man could provide even the necessaries of mere animal life. Of religion, it is certain that in such a state nothing could be known; for there is not the smallest reason to imagine that any individual of the human race—an *Aristotle*, a *Bacon*, or a *Newton*, had he been left alone from his infancy, without culture and without education,—could ever, by the native vigour of his own mind, have discovered the existence of a God, or that such speculations as lead to that discovery would have employed any portion of his time or his thoughts. Even in civilized society it would be impossible, in the present age, for any man, without the assistance of others, to understand the very first principles of our common Christianity; for the scriptures, which alone contain those principles, are written in languages which are now nowhere vernacular. In the fidelity of translators, therefore, every illiterate disciple of Jesus *must* confide, for the truth of those doctrines which constitute the foundation of all his hopes; and as no man ever pretended that the Christian *sacraments* are more necessary to salvation than the Christian *faith*, the Episcopalian sees no impropriety or inconsistency in making those persons receive baptism and the Lord's supper by the ministration of others, who by such ministration must of necessity receive the truths of the gospel.

10 An objection answered.

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11 A permanent order of ministers constituted by Christ.

By such arguments as these does the Episcopalian endeavour to prove that Christ constituted some *permanent order of ministers* in the church, to whom in the externals of religion the great body of Christians are commanded to pay obedience; and thus far the Presbyterian agrees with him; but here their agreement ends. They hand in hand attack the Independent with the same weapons, and then proceed to attack each other. The *one* maintains, that originally the officers of the Christian church were all *presbyters* or *elders* of *one order*, and vested with *equal powers*; whilst the *other* holds, that Christ and his apostles appointed *divers orders* of ministers in the church; that of these orders the highest alone was empowered to ordain others; and that therefore obedience, as to those who watch for our souls, can be due only to such as are *episcopally ordained*.

12 The Presbyterian plea.

In behalf of the Presbyterian plea it is urged, that the titles of *bishop* and *presbyter*, being in the New Testament indifferently given to the same persons, cannot be the titles of distinct ecclesiastical officers; which appears still more evident from the ordination of *Timothy*, who, although he was the first *bishop* of Ephesus, received his episcopal character by the imposition of the hands of the *presbytery*.—That one and the same man is, in the New Testament, styled sometimes a *bishop* and sometimes a *presbyter*, cannot be denied; but although every apostolic bishop was therefore undoubtedly a presbyter, it does not of course follow, says the Episcopalian, that every presbyter was likewise a bishop. In the *Old* Testament, Aaron and his sons are without any discrimination of order frequently styled *priests*; and in the *New*, both St Peter and St John call themselves *presbyters*, as St Paul, upon one occasion, styles himself a *deacon*—διακονος (Eph. iii. 7.): yet no man ever supposed those apostles to have been such ecclesiastical officers as modern presbyters and deacons; and it is universally known, that in the Jewish priesthood there were different orders, and that Aaron was of an order superior to his sons. This being the case, the presbyters, by the laying on of whose hands Timothy was made a bishop, *may have been* of the same order with St Peter and St John; and if so, it follows that his ordination was *Episcopal*. At all events, we are certain, continues the advocate for Episcopacy, that it was not, in the modern sense of the word, *Presbyterian*; for the gift, which in the first epistle is said to have been "given by prophecy *with* the laying on of the hands of the presbytery," is in the second said to have been "in him *by* the putting on of the hands of St Paul." And here it is worthy of observation, that the preposition used in the former case is μετα, which signifies *concurrence* rather than instrumentality; but *that* in the latter is δια, which, as every Greek scholar knows, is prefixed to the *instrumental cause* by which any thing is effected: so that whatever may have been the order of the presbyters

13 Episcopal arguments against it.

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byters who *concurred*, St Paul appears to have been the *ſole* ordainer. But by the confeſſion of all parties, St Paul was a biſhop in the higheſt ſenſe in which that word is ever uſed; and the powers of the epiſcopate not being parcelled out among various partners, of whom each poſſeſſes only a ſhare, the impoſition of his hands was ſufficient for every purpoſe which could have been effected by the hands of the whole college of apoſtles.

It appears, therefore, that from the promiſcuous uſe of the titles *biſhop* and *preſbyter*, and from the *ordination of Timothy*, nothing can with certainty be concluded on either ſide of this celebrated queſtion. But if, inſtead of reſting on mere *words*, which when taken alone and without regard to the context, are almoſt all of ambiguous ſignification, we attend to ſome important *facts* recorded in the New Teſtament, the Epiſcopalian thinks we ſhall in them diſcover ſufficient evidence that the government of the primitive church was prelatical.

During our Saviour's ſtay upon earth, it is undeniable that he had under him two diſtinct orders of miniſters—the twelve, and the ſeventy; and after his aſcenſion, immediately before which he had enlarged the powers of the *eleven*, we read of *apoſtles*, *preſbyters*, and *deacons*, in the church. That the preſbyters were ſuperior to the deacons, and the apoſtles ſuperior to both, is univerſally acknowledged; but it has been ſaid, that in Scripture we find no intimation that the apoſtolic order was deſigned for continuance. A Quaker ſays the ſame thing of water-baptiſm; and the Epiſcopalian obſerves, that it would be difficult to point out by what paſſage of Scripture, or what mode of reaſoning, thoſe who upon this plea reject the apoſtolic order of Chriſtian miniſters, could overthrow the principles upon which the diſciples of *George Fox* reject the uſe of that rite which our Saviour inſtituted for the initiation of mankind into his church. They were the *eleven* alone to whom Chriſt ſaid, "Go ye therefore and teach all nations, baptiſing them in the name of the Father, and of the Son, and of the Holy Ghoſt:" and therefore, although we frequently find preſbyters and deacons adminiſtering the ſacrament of baptiſm, we muſt conclude, that as a *judge* adminiſters juſtice by authority derived from his *ſovereign*, ſo thoſe *inferior officers* of the church adminiſtered baptiſm by authority derived from the *apoſtles*. Indeed, had they pretended to act by any other authority, it is not eaſily to be conceived how *their* baptiſm could have been the baptiſm inſtituted by Chriſt; for it was not with the *external waſhing* by whomſoever performed, but with the *eleven* and their ſucceſſors, that he promiſed to be "always, even unto the end of the world."

14 Three orders of Chriſtian miniſters during our Saviour's ſtay upon earth; and likewiſe after his aſcenſion into heaven.

That the *eleven* did not conſider this promiſe, or the commiſſion with which it was given, as terminating with their lives, is evident from their admitting others into their own order; for which they had competent authority, as having been ſent by Chriſt as he was ſent by his Father. When St Paul, to magnify his office and procure to it from the Galatians due reverence, ſtyles himſelf, "an apoſtle not of men, neither by man, but by Jeſus Chriſt and God the Father," he muſt have known ſome who derived their apoſtolic miſſion *by man*; otherwiſe he could with no propriety have claimed particular reſpect, as he evidently does, from what was in his own apoſtleſhip no particular diſtinction. At that very early period, therefore, there muſt have been in the church *ſecondary* apoſtles, if they may be ſo called, upon whom, by impoſition of hands, or by ſome other ſignificant ceremony, the eleven had conferred that authority which was given to them by their Divine Maſter. Such were *Matthias* and *Barnabas*; ſuch likewiſe were *Timothy*, *Titus*, and the *angels* of the ſeven churches in Aſia, with many others whoſe names and offices are mentioned in the New Teſtament.

15 The apoſtolic or higheſt order deſigned to be permanent.

That *Matthias* and *Barnabas* were of the apoſtolic order, has never been controverted; and that *Timothy* and *Titus* were ſuperior to modern preſbyters, is evident from the offices aſſigned them. Timothy was, by St Paul, empowered to *preſide* over the preſbyters of Epheſus, to receive accuſations againſt them, to *exhort*, to *charge*, and even to *rebuke* them; and Titus was, by the ſame apoſtle, left in Crete for the expreſs purpoſe of ſetting things in order, and ordaining *preſbyters* in *every* city. To *exhort*, to *charge*, and with authority to *rebuke* one's equal, is certainly incongruous; and therefore the Epiſcopalian thinks the powers conferred on Timothy altogether inconſiſtent with that parity of order and of office for which his antagoniſts ſo ſtrenuouſly plead. Even the commiſſion given to Titus appears in his eyes by much too extenſive for a Preſbyterian miniſter, who, after having ordained in *one* city, could not have proceeded to ordain in *another* without the conſent and aſſiſtance of his brother and fellow-labourer. With reſpect to the *angels* of the Aſiatic churches, he obſerves, that in the Old Teſtament the title of *angel* is ſometimes given to the *Jewiſh high-prieſt*, and particularly by the prophet Malachi, who calls him "the *meſſenger* (αγγελος) of the Lord of Hoſts;" and that the *angels* of the churches mentioned by St John, were *Chriſtian high-prieſts*, or *biſhops* preſiding over more than one congregation, as it is affirmed by all the ancient writers, cannot, he thinks, be denied by any man who will take the trouble to compare Scripture with Scripture. We read (Acts xix. 10. and 20.), that "in the ſpace of two years *all they* who dwelt in Aſia heard from St Paul the word of the Lord Jeſus, both Jews and Greeks; and that there the word of God *grew mightily* and *prevailed*:" but with what truth or propriety could this have been ſaid, if at the time of St John's writing the Apocalypſe, which was 30 years after St Paul's death, all the Chriſtians of Proconſular Aſia were compriſed in *ſeven congregations*, which aſſembled, each with its proper paſtor, to perform, in *one place*, the duties of public worſhip? In a word, the advocate for Epiſcopacy inſiſts, that no man, who reads without prejudice the acts of the apoſtles, the epiſtles of St Paul, and the Apocalypſe of St John, can ſeriouſly believe that *Timothy*, *Titus*, *Epaphroditus*, *Soſthenes*, and *Silvanus*, with the *angels* of the ſeven churches in Aſia, were *mere preſbyters*, or that the government of the church was, in thoſe days, by a college of elders.

16 Matthias, Barnabas, Timothy, Titus, and the angels of the ſeven churches in Aſia, biſhops

When from the inſpired penmen of the New Teſtament he proceeds to examine the ſucceeding writers of the Chriſtian church, the Epiſcopalian finds ſuch multiplied and concurring evidence of the apoſtolic inſtitution of epiſcopacy, as he thinks it impoſſible to reſiſt without

Epiſcopacy. without denying the truth of all ancient hiſtory, and even ſhaking the pillars of revelation itſelf; for "in the noble army of martyrs," the witneſſes of the epiſcopal government of the church are earlier, and by far more numerous, than thoſe who teſtify that the *goſpel* of *St Matthew* was written by that apoſtle, or that the book of the *Apocalypſe* is canonical Scripture. The authority of the *fathers* indeed is at preſent very low; but ſhould they be allowed to be as fanciful divines and as bad critics as their worſt enemies are pleaſed to repreſent them, this would detract nothing from their evidence when they bear witneſs to the conſtitution of the church in their own times; for of their *integrity* there can be no doubt: and what the Epiſcopalian wants of them is only their teſtimony to matters of fact which fell under the cognizance of their own ſenſes, and about which therefore they could not be deceived. It is here indeed chiefly that he triumphs over his antagoniſts. In the ſecond and third centuries there was no general council, nor any Chriſtian ſovereign.

17 The divine right of Epiſcopacy. A prelacy therefore, he urges, could not have been *univerſally* introduced, during that period, either by a concert among the clergy, or by the authority of the civil magiſtrate. Yet that even *then* there was no church under heaven, of which the government was not epiſcopal, has been confeſſed by ſome of the moſt learned writers among the Preſbyterians themſelves; whence he concludes that epiſcopacy is of divine inſtitution.

The candid Epiſcopalian, however, allows, that in the apoſtolic age there may have been ſome churches which at firſt had only biſhops and deacons to perform the offices of religion; for when the number of diſciples in any place was ſo ſmall that they could all meet in one aſſembly, there was no neceſſity for any other order of miniſters: but it appears that, from the very *beginning*, *biſhops*, *preſbyters*, and *deacons*, were ſettled in all the *larger* cities of the Roman empire; and it was in thoſe days an allowed maxim, that without a *biſhop* there could be *no church*. The better to underſtand the original ſtate and inſtitution of epiſcopacy, it is neceſſary to obſerve, that the empire, which contained almoſt all the known part of the Chriſtian world, was by Auguſtus Cæſar divided into provinces, ſubjected each to the authority of one chief magiſtrate, who was commonly a *prætor* or *proconſul*, and who reſided in the metropolis or chief city of the province. A province comprehended the cities of a whole region; and in the age of the apoſtles, each city was under the immediate government of certain magiſtrates within its own body, known by the name of *βουλη*, or *ſenatus*, *ordo* and *curia*, "the ſtates and court of the city." Thoſe magiſtrates were ſubordinate to the *prætor* or *proconſul:* but among them there was *one* ſuperior to the reſt, called ſometimes *dictator* and ſometimes *defenſor civitatis*, whoſe juriſdiction extended not only over the city itſelf, but likewiſe over all the adjacent territory. That territory was denominated *περοαστια*, or the ſuburbs, and often reached to the diſtance of 10 or 12 miles round the city, and ſometimes much farther, containing within it many villages and ſmall towns under the government of the city magiſtrates. From ſome paſſages in the New Teſtament, and from the concurring evidence of the earlieſt writers of the church, it appears to have been the purpoſe of the apoſtles to ſettle a biſhop in *every* city where there was a civil magiſtracy; but as they could not be perſonally preſent in all places at once, it was natural for them to *enter* upon the great work of converting the nations by *firſt* preaching the goſpel in that city of each province which was the ordinary reſidence of the governor; becauſe to it there muſt have been the greateſt reſort of people, who would carry the glad tidings with them into the country when they returned. Accordingly, having diſperſed themſelves over the empire, and made numbers of proſelytes in the principal cities, they fixed in each, where they ſaw it neceſſary, a *biſhop*, with a college of *preſbyters* and *deacons;* and gave to thoſe biſhops, who were at firſt called *apoſtles*, a commiſſion, as the *other* cities of the province ſhould be converted, to fix in them biſhops alſo.

18 The origin of dioceſes.

Epiſcopacy.

In ſome of the ſmaller cities, it is extremely probable that a biſhop and a deacon were for a ſhort time the only eccleſiaſtical officers, till the number of Chriſtians increaſed ſo much as to make it impoſſible for them all to aſſemble in one houſe for the purpoſes of public worſhip. The biſhop then ordained *preſbyters* to officiate in thoſe congregations where he himſelf could not be preſent, and to aſſiſt him in other parts of his paſtoral office; but in all their miniſtrations the preſbyters were ſubordinate to him, who was the chief paſtor within the city, who compoſed the prayers which were offered up in public, and to whom all the other miniſters of religion were accountable for their conduct. So long as the number of the faithful was confined within the *walls* of the city, it appears that the biſhop with his preſbyters and deacons lived together as in a college; that divine ſervice was every Lord's day, or oftener, performed in what was afterwards called the cathedral or mother-church, by the biſhop himſelf, aſſiſted by ſome of his clergy; and that the congregations which met in other churches, having no *fixed* paſtors, were ſupplied by ſuch preſbyters as the biſhop choſe to ſend to them from his own church. Whilſt matters continued in this ſtate, the clergy had no other revenues than what aroſe from the voluntary oblations of the people; which were indeed ſo large as not only to ſupport them with decency, but likewiſe to anſwer other ends of charity and munificence. They were commonly divided into four equal parts; of which one was allotted to the biſhop, a ſecond to the inferior clergy, a third to the poor, and a fourth to keep the churches in repair; and it was conſidered as a part of the biſhop's duty to take care that the offerings ſhould be faithfully applied to theſe purpoſes.

19 The origin of pariſhes. When converts increaſed in number, and churches were built in the ſuburbs, each of thoſe churches had a fixed paſtor ſimilar to a pariſh-prieſt among us; but ſtill thoſe paſtors, as well as the city-clergy, miniſtered in ſubordination to the biſhop, whoſe authority extended as far as the civil authority of the Roman magiſtrate, within which diſtrict or dioceſe it was ſupreme over all orders of Chriſtians. This every man knows who is acquainted with eccleſiaſtical hiſtory; for the biſhop alone could ordain *prieſts* and *deacons*, adminiſter the rite of *confirmation*, *abſolve penitents* who were under church-cenſure, and *exclude from communion* heretics and notorious offenders; and from his ſentence there lay no appeal but to a ſynod of comprovincial biſhops.

Such ſynods were in each province convened by the biſhop

Epiſcopacy. biſhop of the chief city; for the apoſtles having been careful to place in thoſe cities men of the moſt eminent gifts and abilities, the other biſhops of the provinces applied to them for advice upon every emergency, and paid a particular deference to them upon every occaſion. So that though all biſhops were of equal authority as *biſhops*, yet when they met to conſecrate a new biſhop, or to deliberate upon the affairs of the church, they yielded a precedency to the biſhop of the metropolis, who called them together, and who ſat as

20 The origin of metropolitans. *preſident* or *moderator* of the ſynod. Hence the origin of metropolitans or *archbiſhops;* whoſe authority was ſo conſiderable, that though there is not a doubt but the *election* of biſhops was anciently placed in the clergy and people of the vacant dioceſe, yet the biſhop *elect* could not be *conſecrated* without the conſent of the archbiſhop of the province.

In conſequence of the extenſive powers with which the primitive biſhops were veſted, they are commonly ſtyled in the writings of thoſe times *preſidents*, *provoſts*, or *inſpectors* of the church, *chief prieſts*, *princes of the clergy*, and even *princes of the people;* but their authority was wholly ſpiritual. Thoſe prelates, imitating the example of their Divine Maſter when on earth, neither poſſeſſed nor aſſumed to themſelves any juriſdiction over the *properties* or *civil rights* of men. In conſequence of St Paul's having reprimanded the Corinthians for going to law before the *unbelievers*, they were indeed often choſen as *arbiters* of ſuch civil diſputes as aroſe between individuals under their epiſcopal government; but on theſe occaſions they could not act unleſs the ſubmiſſion was *voluntarily* made by *both* the contending parties, and *then* their deciſion was final. When the empire became Chriſtian, this privilege was confirmed to them by law; for any *civil* cauſe depending before a court of juſtice could be withdrawn, and by the mutual conſent of parties be ſubmitted to the arbitration of the biſhop, whoſe award, which in former times could be enforced only by the terror of church-cenſures, was then enforced by the ſecular magiſtrate. In *criminal* cauſes, where the trial might be for life or death, they were prohibited both by the canons of the church and by the laws of the ſtate from acting as judges; and therefore they never ſuffered ſuch cauſes to come before them, except when it was neceſſary that the perſon accuſed, if found guilty, ſhould be excluded from the communion of the faithful. But they had ſo many civil cauſes flowing in upon them, that they were ſoon obliged to devolve

21 The probable origin of ſpiritual courts. part of that care upon other perſons, in whoſe knowledge, prudence, and integrity, they could fully confide: and as the perſons employed to act in the biſhop's ſtead were often *laymen*, it has been conjectured that they gave riſe to the office of *lay-chancellor* in the church, and to all that train of ſpiritual judges and ſpiritual courts againſt which ſuch numbers are diſpoſed to clamour.

Be this as it may, it is certain that, through the piety and munificence of the Chriſtian emperors, the biſhops enjoyed large revenues and many valuable privileges; but it does not appear that they had any rank or authority, as *barons* or *temporal princes*, till the Gothic nations, which ſubverted the Roman empire, had embraced the Chriſtian faith. As Chriſtianity incapacitated the leaders of thoſe tribes from officiating as chief prieſts at the religious rites which were uſually celebrated at the opening of their public aſſemblies, the biſhops came naturally to diſcharge that duty on ſuch occaſions, when they muſt have ſhared in the rank by ſharing in the functions of the chief. The ſituation in which they thus appeared at the opening of all political conventions, would enable them to join with much effect in the deliberations which enſued; and their ſuperior knowledge, their ſacred character, and their influence with the people, would ſoon acquire them power equal to their rank. They muſt therefore have been well entitled to demand admiſſion into that council which was formed by the king and the lay-chiefs at the national aſſemblies: and as they balanced the authority of thoſe chiefs, we cannot doubt that the king would be diſpoſed to give the utmoſt effect to their claim. Accordingly, we find the dignified clergy, who received large grants of land to be held on the ſame tenures with the lands of the lay-magiſtrates, preſiding along with thoſe magiſtrates in the provincial aſſemblies of every degree in all the Gothic nations, and enjoying every advantage in point of rank and authority in their national diets. Hence the biſhop of Rome, and ſeveral biſhops in Germany, have, like the dukes and marquiſes of that empire, been for a long time ſovereign princes; and hence too the biſhops of England and Ireland have always ſat, and have an equal right with the lay-peers to ſit, in the upper houſe of parliament. It is however obvious, that, ſo far as epiſcopacy is of *apoſtolical* inſtitution, thoſe peers and princes poſſeſs not the *original* character in any higher degree than the biſhops in America, who are barely tolerated, or than thoſe in Scotland who do not enjoy that privilege; and that confirmation adminiſtered, or holy orders conferred, by a perſecuted prelate, muſt be as effectual to the purpoſes of religion, as if given by a German prince or an Engliſh peer.

Epiſcopacy. 22 Biſhops had no civil rank till after the ſubverſion of the Roman empire and the converſion of the Gothic nations.

In this ſhort view of epiſcopacy, it has been our endeavour to do juſtice to the ſubject, without ſuffering ourſelves to be influenced by partiality or prejudice. As we are not ourſelves epiſcopalians, we have advanced nothing of our own; but have ſelected from Engliſh writers, who have at different times undertaken to defend the *divine right* of epiſcopacy, ſuch facts and arguments as to us appear to be of the moſt importance, or to have the greateſt weight, without remarking upon them, or offering any anſwer. The reaſoning employed to prove that the order of biſhops was inſtituted by the apoſtles, is taken from a work prepared for the preſs by Dr Berkeley prebendary of Canterbury, and ſon of the celebrated biſhop of Cloyne. For the reſt of the detail we are indebted chiefly to Bingham's *Origines Eccleſiaſticæ;* a performance in great eſtimation with thoſe Engliſh divines who are commonly known by the appellation of *high churchmen*. As editors of a work of this kind, it is not *our* buſineſs to be of *any party*, or to ſupport, in oppoſition to all others, a *particular* church, though that church ſhould be our own: We ſhall therefore treat *independency* and *preſbytery* as we have treated *epiſcopacy*, by employing ſome able writer of each ſociety to plead his own cauſe. Meanwhile, we ſhall conclude this article with a few reflections, which, though they come from the pen of an obſcure author, deſerve to be engraved deep in the memory of every controverſiſt of every communion.

" On

Epiſcopacy.

23 Moderation in controverſy recommended.

"On complicated queſtions (ſays a late apologiſt for the epiſcopal church in Scotland), men will always differ in opinion; but conſcious each of the weakneſs of his own underſtanding, and ſenſible of the bias which the ſtrongeſt minds are apt to receive from thinking long in the ſame track, they ought to differ with charity and meekneſs. Since unhappily there are ſtill ſo many ſubjects of debate among thoſe who name the name of Chriſt; it is doubtleſs every man's duty, after diveſting himſelf as much as poſſible of prejudice, to inveſtigate thoſe ſubjects with accuracy, and to adhere to that ſide of each diſputed queſtion which, after ſuch inveſtigation, appears to him to be the truth: but he tranſgreſſes the favourite precept of his divine Maſter, when he caſts injurious reflections, or denounces anathemas, upon thoſe who, with equal ſincerity, may view the matter in a different light; and by his want of charity does more harm to the religion of the *Prince of Peace*, than he poſſibly could do good, were he able to convert all mankind to his own orthodox opinions."

24 Epiſcopal church of Scotland.

The following is a ſhort hiſtory of the epiſcopal church of Scotland, extracted from a more detailed account by a member of that church.

The real tenets of the Scotch epiſcopalians, or members of what was at one period the eſtabliſhed church of Scotland, he obſerves, appear to be very imperfectly underſtood. About the time of the reformation from popery, the want of order and decency in the worſhip of the reformed church was abolithed in the reign of James VI. by the eſtabliſhment of epiſcopacy on very liberal principles. This mode of worſhip obtained the ſanction of the moſt reſpectable part of the nation, and continued to flouriſh under the auſpices of government, till it was overthrown by the ſticklers for the *national covenant*. Its reſtoration was effected in the year 1662, and twenty-ſeven years afterwards it was again abolithed by the advocates of the prince of Orange.

It may be proper to obſerve, that the Scotch epiſcopal church had no public liturgy during her legal eſtabliſhment. It is indeed true, that the Engliſh book of common prayer was uſed by the firſt reformers, and there is reaſon to believe that John Knox himſelf was by no means inimical to ſet forms of prayer, nor to clerical ſubordination; but his ſucceſſor, Andrew Melvil, a man much inferior to him in point of erudition, introduced an equality among the clergy, and excited the odium of the people againſt the liturgy to ſuch a degree, that an attempt to modify the prayer book for the uſe of the church of Scotland, was productive of the ſolemn league and covenant, and the ſubſequent ruin of the unfortunate Charles.

During the reign of William III. the epiſcopalians were treated with ſome degree of ſeverity, becauſe they could not tranſfer that allegiance to him which they had ſworn to King James. It is ſaid that they were prohibited from officiating on the ſabbath day, except "in their own hired houſes, where they received ſuch friends as choſe to come in unto them." In this manner was their worſhip conducted, praying either extempore, or from premeditation, till the acceſſion of Queen Anne, when the Engliſh liturgy was introduced by degrees into Scotland, under the ſanction of an act of parliament, paſſed on the 3d of March 1712, "to prevent the diſturbing of thoſe of the epiſcopal communion in that part of Great Britain called Scotland, in the exerciſe of their religious worſhip, and in the uſe of the liturgy of the church of England." But as their attachment to the houſe of Stuart was well known, they were, at the rebellion of 1715, laid under ſome reſtraints, yet neither ſevere in their nature, nor of any long continuance, ſince in 1720 their places of worſhip were as numerous as before, and frequented by numbers both of rank and reſpectability, many of whom held places under government. Epiſcopacy || Epiſcopius.

In England, Dr Sancroft, archbiſhop of Canterbury, with five other biſhops, were deprived of their ſees for refuſing their allegiance to King William, which occaſioned a ſchiſm in the church, as they were extremely popular. Different opinions were entertained reſpecting the nature and deſign of the Lord's ſupper, and the controverſy infected the epiſcopalians of Scotland. The introduction of prayers into public worſhip in behalf of departed friends, was at leaſt a very impolitic ſtep at ſuch a critical period, when every thing favouring of popery was held in the utmoſt abhorrence. On the death of Dr Roſe, the proſcribed biſhop of Edinburgh, the dioceſan form of church government was oppoſed by ſuch of the preſbyters as had been raiſed to the epiſcopal dignity, and it was propoſed to govern the whole church by a college of biſhops. This plan, for the adoption of which no precedent could be found in the annals of hiſtory, was ſucceſsfully oppoſed by many of the moſt enlightened biſhops, and it was of conſequence abandoned.

The Scotch epiſcopalians, it is well known, were always charged with an undue attachment to the Stuart family, which was even conſidered as their moſt diſtinguiſhing tenet; yet there is ſome reaſon to believe that the public opinion of this matter was rather exaggerated. They have invariably maintained that the Almighty, and not the people, is the ruler of princes, which fairly places them beyond the imputation of a republican or levelling ſpirit. The ſeveral reſtraints laid on Scotch epiſcopalians from time to time, with a view to eradicate their attachment to the Stuart family, were happily removed in the year 1792, and they enjoyed a free toleration like the reſt of diſſenters. It was about this time that the clergy of this church, with a very few exceptions, took the oaths of abjuration and allegiance.

It is well known, it is added by the ſame writer, from whoſe account the above is taken, that in Scotland there are chapels quite diſtinct from the Scotch epiſcopal church, where clergymen who have been ordained either in England or Ireland, make uſe of the liturgy of the church of England; but as each of theſe is ſtrictly and properly independent of the reſt, and under the guardianſhip of no biſhop whatever, thoſe who attend them have, in every ſenſe of the word, a much better claim to the appellation of *congregationaliſts* than to that of *epiſcopalians*.

EPISCOPAL, ſomething belonging to BISHOPS.

EPISCOPALIANS, in church hiſtory, an appellation given to thoſe who prefer the epiſcopal government and diſcipline to all others. See EPICOPACY.

By the teſt act, none but Epiſcopalians, or members of the church of England, are qualified to enjoy any office civil or military.

EPISCOPIUS, SIMON, one of the moſt learned

Epiſcopus || Epiſtle.

men of the 17th century, and the chief ſupporter of the Arminian ſect, was born at Amſterdam in 1583. In 1612, he was choſen divinity profeſſor at Leyden, in the room of Gomarus, who reſigned; and the functions of his office, with his private ſtudies, were light burdens to him, compared with the difficulties he ſuſtained on account of the Arminian controverſy: which, though it began in the univerſities, ſoon flew to the pulpits, from whence it ſpread and inflamed the people. The ſtates of Holland having invited Epiſcopius to take his place at the ſynod of Dort, he went thither accompanied by ſome remonſtrant miniſters; but the ſynod would not allow them to ſit as judges, nor to appear in any other capacity than as perſons ſummoned before them: they ſubmitted, were depoſed from their functions, and baniſhed the territories of the commonwealth. Epiſcopius and his perſecuted brethren retired to Antwerp; but the times growing more favourable, he returned to Holland in 1626, and was made miniſter of the church of the Remonſtrants at Rotterdam: in 1634 he was choſen rector of the college founded by the ſect at Amſterdam, where he ſpent the remainder of his days. He died in 1643 of the ſame diſorder which had killed his wife before, a retention of urine; having loſt his ſight ſome weeks previous to his end. The learned have beſtowed great eulogiums on Epiſcopius; but he did not always write with that moderation which might have been wiſhed. His works make two volumes in folio, of which the ſecond conſiſts of poſthumous publications.

EPISCOPUS, the ſame with biſhop. See BISHOP and EPISCOPACY.

EPISODE, in *Poetry*, a ſeparate incident, ſtory, or action, which a poet invents, and connects with his principal action, that his work may abound with a greater diverſity of events; though, in a more limited ſenſe, all the particular incidents whereof the action or narration is compounded are called *epiſodes*. See POETRY.

EPISPASTIC, in *Medicine*, a topical remedy, which being applied to the external parts of the body, attracts the humours to that part.

EPISTATES, in the Athenian government, was the preſident of the proedri. See PROEDRI.

EPISTEMONARCH, in the ancient Greek church, an officer of great dignity, who had the care of every thing relating to faith, in the quality of cenſor. His office anſwered pretty nearly to that of maſter of the ſacred palace at Rome.

EPISTLE, denotes the ſame with a miſſive letter; but is now chiefly uſed in ſpeaking of ancient writings, as the epiſtles of St Paul, epiſtles of Cicero, epiſtles of Pliny, &c.

EPISTLES and Goſpels, in the liturgy of the church of England, are ſelect portions of ſcripture, taken out of the writings of the evangeliſts and apoſtles, and appointed to be read, in the communion ſervice, on Sundays and holidays. They are thought to have been ſelected by St Jerome, and by him put into the lectionary. It is certain, they were very anciently appropriated to the days whereon we now read them, ſince they are not only of general uſe throughout the weſtern church, but are alſo commented upon in the homilies of ſeveral ancient fathers, which are ſaid to have been preached upon thoſe very days to which theſe portions of ſcripture are now affixed. Epiſtolary || Epitaph.

The epiſtles and goſpels are placed in an admirable order and method, and bear a ſpecial relation to the ſeveral days whereon they are read. The year is diſtinguiſhed into two parts; the firſt being deſigned to commemorate Chriſt's living among us, the other to inſtruct us to live after his example. The former takes in the whole time from Advent to Trinity-Sunday; the latter, all the Sundays from Trinity to Advent. During the firſt of theſe ſeaſons, the epiſtles and goſpels are calculated to raiſe in us a grateful ſenſe of what our Saviour did and ſuffered for us, and ſet before our eyes his nativity, circumciſion, and manifeſtation to the Gentiles; his doctrines and miracles; his baptiſm, faſtings, and temptation; his agony and bloody ſweat; his croſs and paſſion; his death, burial, reſurrection, and aſcenſion; and his miſſion of the Holy Ghoſt. During the ſecond ſeaſon of the year, the epiſtles and goſpels tend to inſtruct us in the true paths of Chriſtianity. See COLLECTS.

EPISTOLARY, ſomething belonging to an epiſtle, ſee EPISTLE.

EPISTOLARY Compoſitions. See LETTER; and the article POETRY.

EPISTROPHE. See ORATORY.

EPISTYLE, in the ancient architecture, a term uſed by the Greeks for what we call *architrave*, viz. a maſſive piece of ſtone or wood, laid immediately over the capital of a column.

EPITAPH (from επι, *upon*, and ταφος, *ſepulchre*), a monumental inſcription, in honour or memory of a perſon deceaſed. It has been diſputed whether the ancient Jews inſcribed epitaphs on the monuments of the dead; but be this as it will, epitaphs it is certain, of very ancient date, are found amongſt them.—The Athenians, by way of epitaph, put only the name of the dead, with the epithet χρηστος, ſignifying "good," or ἡρως, "hero," and the word χαιρε, ſignifying their good wiſhes: The name of the deceaſed's father and his tribe were frequently added.—The Lacedemonians allowed epitaphs to none but thoſe who had died in battle. The Romans inſcribed their epitaphs to the *manes*, *diis manibus*; and frequently introduced the dead by way of proſopopœia, ſpeaking to the living; of which we have a fine inſtance, worthy the Auguſtan age, wherein the dead wife thus beſpeaks her ſurviving huſband:

Immatura peri; ſed tu, felicior, annos
Vive tuos, conjux optime, vive meos.

The epitaphs of the preſent day are generally crammed with fulſome compliments which were never merited, characters which human nature in its beſt ſtate could ſcarce lay claim to, and expreſſions of reſpect which were never paid in the life-time of the deceaſed. Hence the proverb with great propriety took its riſe, "He lies like an epitaph."

EPITAPH, is alſo applied to certain eloges, either in proſe or in verſe, compoſed without any intent to be engraven on tombs; as, that of Alexander,

Sufficit huic tumulus, cui non ſufficeret orbis.

and that of Newton,

Iſaacum

Epitafis || Epitropus.

Epizeuxis || Epulares.

Iſaacum Newton,
Quem immortalem
Teſtantur Tempus, Natura, Cælum;
Mortalem hoc marmor
Fatetur.

EPITASIS, in ancient poetry, the ſecond part or diviſion of a dramatic poem, wherein the plot, entered upon in the firſt part or *protaſis*, was carried on, heightened, and worked up, till it arrived at its ſtate or height, called *cataſtaſis*.

EPITASIS, in *Medicine*, the increaſe of a diſeaſe or beginning of a paroxyſm, particularly in a fever.

EPITHALAMIUM, in *Poetry*, a nuptial ſong or compoſition in praiſe of the bride and bridegroom, praying for their proſperity, for a happy offspring, &c.

Epithalamia were ſung amongſt the Jews, at the door of the bride, by her friends and companions, the evening before the marriage. Pſalm xlv. is an epithalamium. Among the Greeks the epithalamium was ſung as ſoon as the married couple were gone to bed, and attended with ſhouts and ſtamping of the feet to drown the cries of the bride. They returned in the morning, and with the ſame ſong, a little altered, ſaluted them again. The evening ſong was called επιθαλαμια κοιμητικα, the morning ſalute was called επιθαλαμια εγερτικα. This was the practice amongſt the Romans alſo, but their epithalamia were often obſcene.

EPITHEM, in *Pharmacy*, a kind of fomentation, or remedy of a ſpirituous or aromatic kind, applied externally to the regions of the heart, liver, &c. to ſtrengthen and comfort the ſame, or to correct ſome intemperature thereof.

EPITHET, in *Poetry* and *Rhetoric*, an adjective expreſſing ſome quality of a ſubſtantive to which it is joined; or ſuch an adjective as is annexed to ſubſtantives by way of ornament and illuſtration, not to make up an eſſential part of the deſcription. Nothing, ſays Ariſtotle, tires the reader more than too great a redundancy of epithets, or epithets placed improperly; and yet nothing is ſo eſſential in poetry as a proper uſe of them. The writings of the beſt poets are full of them.

EPITOME, in literary hiſtory, the ſame with ABRIDGEMENT.

EPITRITUS, in proſody, a foot conſiſting of three long ſyllables and one ſhort. Of theſe, grammarians reckon four kinds: the firſt conſiſting of an iambus and ſpondee, as fălūtāntēs; the ſecond, of a trocheus and ſpondee, as cōncĭtātī; the third of a ſpondee, and an iambus, as cōmmūnĭcāns; and the fourth, of a ſpondee and trocheus, as īncāntārĕ. See the articles SPONDEUS, TROCHEUS, &c.

EPITROPE. See ORATORY, N° 83.

EPITROPUS, a kind of judge, or rather an arbitrator, which the Greek Chriſtians, under the dominion of the Turks, elect in the ſeveral cities, to terminate the differences that ariſe among them, and avoid carrying them before the Turkiſh magiſtrates. See ARBITRATOR.

Anciently the Greeks uſed the term επιτροπος, in the ſame ſenſe as the Latins did *procurator*, viz. for a commiſſioner or intendant. Thus the commiſſioners of proviſions in the Perſian army are called by Herodotus and Xenophon *epitropi*. In the New Teſtament, επιτροπος denotes the ſteward of a houſehold, rendered in the vulgate *procurator*.

EPIZEUXIS. See ORATORY, N° 68.

EPOCHA, in *Chronology*, a term or fixed point of time whence the ſucceeding years are numbered or counted. See ÆRA.

EPODE, in lyric poetry, the third or laſt part of the ode, the ancient ode being divided into ſtrophe, antiſtrophe, and epode. See ODE, &c.

The epode was ſung by the prieſts, ſtanding ſtill before the altar, after all the turns and returns of the ſtrophe and antiſtrophe, and was not confined to any preciſe number or kind of verſes.

The epode is now a general name for all kinds of little verſes that follow one or more great ones, of what kind ſoever they be; and in this ſenſe a pentameter is an epode after an hexameter. And as every little verſe, which, being put after another, cloſes the period, is called *epode*; hence the ſixth book of Horace's odes is intitled *liber epodon*, "book of epodes," becauſe the verſes are all alternately long and ſhort, and the ſhort ones generally, though not always, cloſe the ſenſe of the long one.

EPOPOEIA, in *Poetry*, the hiſtory, action, or fable, which makes the ſubject of an epic poem. The word is derived from the Greek επος, *carmen*, "verſe;" and ποιεω, *facio*, "I make."

In the common uſe of the word, however, *epopœia* is the ſame with *epos*, or epic poem itſelf. See the article POETRY.

EPOPS, or HOOPOE. See UPUPA, ORNITHOLOGY *Index*.

EPSOM, a town of Surry, about 16 miles ſouth-weſt from London, long famous for its mineral waters. Theſe were diſcovered in 1618; and though not in ſuch repute as formerly, yet they are not impaired in virtue, and the ſalt made from them is famous all over Europe, for gently cleanſing and cooling the body. The hall, galleries, and other public apartments, are now run to decay; and there remains only one houſe on the ſpot, which is inhabited by a countryman and his wife, who carry the waters in bottles to the adjacent places, and ſupply the demands of dealers in London. On the neighbouring downs are annually horſe-races; but the inns, ſhops, and bowling-greens are not near ſo much frequented as formerly. The market is on Friday; fair, July 25. The town is about one mile and a half in ſemicircle, from the church to the palace at Durdans, which was burnt down ſome years ſince, but has been rebuilt. It was once inhabited by his preſent majeſty's father. In Hudſon's Lane here was Epſom Court, an ancient Saxon ſeat, long ſince converted into a farm. Here are ſo many fields, meadows, orchards, gardens, and the like, that a ſtranger would be at a loſs to know whether this was a town built in a wood, or a wood ſurrounded by a town.

Epſom water is eaſily imitated by art; i. e. by only diſſolving half an ounce of Epſom ſalt in a quart of pure water, made ſomewhat briſk or quick by adding a little ſulphuric acid and potaſh, ſo as to let the alkali prevail.

EPULARES, in antiquity, an epithet given to thoſe who were admitted to the ſacred *epulæ* or entertainments,

Epulo || Equator.

tainments, it being unlawful for any to be preſent at them who were not pure and chaſte.

EPULO, in antiquity, the name of a miniſter of ſacrifice among the Romans.

The pontifices, not being able to attend all the ſacrifices performed at Rome to ſo many gods as were adored by that people, appointed three miniſters, whom they called *epulones*, becauſe they conferred on them the care and management of the *epula*, feaſts in the ſolemn games and feſtivals. To them belonged the ordering and ſerving the ſacred banquet, offered on ſuch occaſions to Jupiter, &c. They wore a gown bordered with purple like the pontifices. Their number was at length augmented from three to ſeven, and afterwards by Cæſar to ten. Their firſt eſtabliſhment was in the year of Rome 558, under the conſulate of L. Furius Purpureo and M. Claudius Marcellus.

EPULUM, in antiquity, a holy feaſt prepared for the gods in times of public danger. The feaſt was ſumptuous, and the gods were formally invited and attended; for the ſtatues were brought on rich beds furniſhed with ſoft pillows, called *pulvinaria*: Thus accommodated, their godſhips were placed on their couches at the moſt honourable part of the table. The care of the *epula* belonged to the *epulones*, and the gods were plentifully ſerved with the richeſt dainties, as if they were able to eat; but the *epulones* performed that function for them, and doubtleſs were competent proxies! No wonder that Pliny ſolicited Trajan to be admitted of their order.

EPULUM is alſo uſed to ſignify any ſolemn feaſt; ſo we meet with *epulum ferale*, "a funeral entertainment."

EQUABLE, an appellation given to ſuch motions as always continue the ſame in degree of velocity, without being either accelerated or retarded.

EQUAL, a term of relation between two or more things of the ſame magnitude, quantity, or quality.

Mathematicians ſpeak of *equal* lines, angles, figures, circles, ratios, ſolids.

EQUALITY, that agreement between two or more things, whereby they are denominated equal.

EQUANIMITY, in *Ethics*, denotes that even and calm frame of mind and temper, under good or bad fortune, whereby a man appears to be neither puffed up nor overjoyed with proſperity, nor diſpirited, ſoured, or rendered uneaſy by adverſity.

EQUATIONS, in *Algebra*. See ALGEBRA.

EQUATION of Time, in *Aſtronomy* and *Chronology*, the reduction of the apparent time or motion of the ſun, to equable, mean, or true time. See ASTRONOMY *Index*.

EQUATOR, or ÆQUATOR, in *Aſtronomy* and *Geography*, a great circle of the ſphere, equally diſtant from the two poles of the world, or having the ſame poles with thoſe of the world. It is called the *equator*, becauſe when the ſun is in it the days and nights are *equal*; whence alſo it is called the *equinoctial*; and when drawn on maps and planiſpheres, the *equinoctial line*, or ſimply the *line*. Every point of the equator is a quadrant's diſtance from the poles of the world; whence it follows, that the equator divides the ſphere into two hemiſpheres, in one of which is the northern, and in the other the ſouthern pole.

EQUATORIAL INSTRUMENT. See ASTRONOMY *Index*.

Equatorial || Equeſtrian.

EQUERY, or ECURY, a grand ſtable or lodge for horſes, furniſhed with all the conveniences thereof; as ſtalls, manger, rack, &c. The word is formed from the French *eſcurie*, which ſignifies the ſame thing. Some again derive *eſcurie* from the Latin *ſcuria*, which not only denotes a place for beaſts to be put up in, but alſo a grange or barn. But a more probable derivation is from *equile*, "a ſtable for horſes," of *equus*, "horſe." Some hold that the word *ſtable*, in propriety, relates only to bullocks, cows, ſheep, hogs, &c. and *equery*, to horſes, mules, &c.

A *ſimple equery* is that provided for one row of horſes; a *double equery* that provided for two, with a paſſage in the middle, or two paſſages; the horſes being placed head to head, as in the little equery at Verſailles.

Under equery are ſometimes alſo comprehended the lodgings and apartments of the equerries, grooms, pages, &c.

EQUERY (*eſcuyer*), is alſo an officer who has the care and management of the horſes of a king or prince.

EQUERIES, or EQUERRIES, popularly called *Querries*, are particularly uſed among us for officers of the king's ſtables, under the maſter of the horſe, ſeven in number, who, when his majeſty goes abroad, ride in the leading coach, are in waiting one at a time monthly, and have a table with the gentlemen uſhers during the time, and a ſalary of 300l. a-year each. They uſed to ride on horſeback by the coach ſide when the king travelled; but that being more expenſive to them than neceſſary to the ſovereign, it has been diſcontinued.

EQUERIES of the Crown Stable have that appellation, as being employed in managing and breaking the ſaddle-horſes, and preparing them for the king's riding. Theſe are two in number; the firſt having an annual ſalary of 256l. and the ſecond 200l. whereof one is, or always ſhould be, in cloſe waiting at court; and when his majeſty rides, holds the ſtirrup, while the maſter of the horſe, or one of the equeries in his abſence, aſſiſts in mounting him; and when his majeſty rides, they uſually attend him.

EQUES, in antiquity. See *EQUESTRIAN Order* and EQUITES.

EQUES Auratus, is uſed to ſignify a knight-bachelor, called *auratus*, q. d. *gilt*, becauſe anciently none but knights might gild or beautify their armour or other habiliments of war with gold. In law this term is not uſed, but inſtead of it *miles*, and ſometimes *chevalier*.

EQUESTRIA, among the Romans, a place in the theatre where the equites or knights ſat.

EQUESTRIAN (*Equeſtris*), a term chiefly uſed in the phraſe *equeſtrian ſtatue*, which ſignifies a ſtatue repreſenting a perſon mounted on horſeback. The word is formed of the Latin *eques*, "knight, horſeman," of *equus*, "horſe."

EQUESTRIAN Games, among the Romans, horſe-races, of which there were five kinds, the *prodromus* or *plain horſe-race*, the *chariot-race*, the *decurſory-race* about funeral piles, the *ludi ſevirales*, and the *ludi neptunales*.

EQUESTRIAN Order, among the Romans, ſignified their

Equiangular || Equinox.

their knights or equites; as alſo their troopers or horſemen in the field; the firſt of which orders ſtood in contradiſtinction to the ſenators; as the laſt did to the foot, military, or infantry. Each of theſe diſtinctions was introduced into the ſtate by Romulus.

EQUIANGULAR, in *Geometry*, an epithet given to figures whoſe angles are all equal: ſuch are a ſquare, an equilateral triangle, &c.

EQUIDISTANT, an appellation given to things placed at equal diſtances from ſome fixed point or place to which they are referred.

EQUILATERAL, in general, ſomething that hath equal ſides; as an equilateral triangle.

EQUILIBRIUM, in *Mechanics*, is when the two ends of a lever or balance hang ſo exactly even and level, that neither doth aſcend or deſcend, but both keep in a poſition parallel to the horizon; which is occaſioned by their being both charged with an equal weight.

EQUIMULTIPLES, in *Arithmetic* and *Geometry*, are numbers or quantities multiplied by one and the ſame number or quantity. Hence, equimultiples are always in the ſame ratio to each other as the ſimple quantities before multiplication; thus, if 6 and 8 are multiplied by 4, the equimultiples 24 and 32 will be to each other as 6 to 8.

EQUINOCTIAL, or ÆQUINOCTIAL, in *Aſtronomy*, a great and immoveable circle of the ſphere, under which the equator moves in its diurnal motion.

The equinoctial or equinoctial line is ordinarily confounded with the equator: but there is a difference; the equator being moveable, and the equinoctial immoveable; and the equator being drawn about the convex ſurface of the ſphere, but the equinoctial on the concave ſurface of the magnus orbis.

Whenever the ſun in his progreſs through the ecliptic comes to this circle, it makes equal days and nights all around the globe; as then riſing due eaſt and ſetting due weſt, which he never does at any other time of the year. And hence the denomination from *æquus* and *nox*, "night," *quia æquat diem nocti*.

The equinoctial then is the circle which the ſun deſcribes, or appears to deſcribe, at the time of the equinoxes; that is, when the length of the day is everywhere equal to that of night, which happens twice a-year. See EQUINOX.

EQUINOCTIAL, in *Geography*. See EQUATOR.

The ſhadows of thoſe who live under this circle are caſt to the ſouthward of them for one half of the year, and to the northward of them during the other half; and twice in a year, viz. at the equinoxes, the ſun at noon caſts no ſhadow, being in their zenith.

From this circle is the declination or latitude of places accounted in the degrees of the meridian.

EQUINOCTIAL Points, are the two points wherein the equator and ecliptic interſect each other: the one being in the firſt point of Aries, is called the *vernal point* or *equinox*; and the other in the firſt point of Libra, the *autumnal point* or *equinox*.

EQUINOCTIAL Dial, is that whoſe plane lies parallel to the equinoctial. See DIAL.

EQUINOX, or ÆQUINOX, in *Aſtronomy*, the time when the ſun enters one of the equinoctial points.

The equinoxes happen when the ſun is in the equinoctial circle; when of conſequence the days are equal to the nights throughout the world, which is the caſe twice a-year, viz. about the 20th of March and the 23d of September, the firſt of which is the vernal and the ſecond the autumnal equinox.

Equipage || Equity.

It is found by obſervation, that the equinoctial points, and all the other points of the ecliptic, are continually moving backward, or *in antecedentia*, that is, weſtward. This retrograde motion of the equinoctial points, is that famous and difficult phenomenon called the *preceſſion of the equinoxes*. See ASTRONOMY *Index*.

EQUIPAGE, in the military art, denotes all ſorts of utenſils, artillery, &c. neceſſary for commencing and proſecuting with caſe and ſucceſs any military operations. Camp and field equipage conſiſts of tents, kitchen-furniture, ſaddle-horſes, baggage, waggons, bat-horſes, &c.

To EQUIP, in naval language, a term borrowed from the French marine, and frequently applied to the buſineſs of fitting a ſhip for ſea, or arming her for war.

EQUIPOLLENCE, in *Logic*, is when there is an equivalence between any two or more terms or propoſitions; i. e. when they ſignify one and the ſame thing, though they expreſs it differently. Such propoſitions, &c. are ſaid to be *equipollent*.

EQUIRIA, in antiquity, a feſtival inſtituted by Romulus, and celebrated on the 27th of February, in honour of Mars, at which there were horſe-races.

EQUISETUM, HORSE-TAIL: A genus of plants belonging to the cryptogamia claſs; and in the natural method ranking under the 51ſt order, *Coniferæ*. See BOTANY *Index*.

EQUITES, amongſt the Romans, were perſons of the ſecond degree of nobility, immediately ſucceeding the ſenators in point of rank. The *equites* or knights were required to be poſſeſſed of 400 *ſeſtertia* before they could be admitted into that order; and when the knights were ſo reduced as to fall ſhort of the preſcribed revenue, they were expunged out of the equeſtrian liſt. The equeſtrian revenue juſt mentioned amounted to about 10,000 crowns.

Part of the ceremony whereby the honour of knighthood was conferred amongſt the Romans was the giving of a horſe; for every *eques* or knight had a horſe kept at the public charge, he received alſo the ſtipend of a horſeman to ſerve in the wars, and wore a ring which was given him by the ſtate. The *equites* compoſed a large body of men, and conſtituted the Roman cavalry; for there was always a ſufficient number of them in the city, and nothing but a review was requiſite to fit them for ſervice.

The knights at laſt grew too powerful, were a balance for the ſenate and people, neglected the exerciſes of war, and betook themſelves to civil employments. The *equites* were liable to be puniſhed by the cenſors, and to ſuffer degradation. They were degraded by taking from them the horſe which was kept for each of them at the public charge; this was called *equum adimere*.

EQUITY, in a general ſenſe, the virtue of treating all other men according to reaſon and juſtice, or as we would gladly be treated ourſelves when we underſtand aright what is our due. See JUSTICE.

EQUITY, in juriſprudence, is defined a correction or qualification of the law, generally made in that part wherein it faileth or is too ſevere. It likewiſe ſignifies the

Equity || Equivocation.

the extenſion of the words of the law to caſes unexpreſſed, yet having the ſame reaſon; ſo that where one thing is enacted by ſtatute, all other things are enacted that are of the like degree. For example, the ſtatute of *Glouc.* gives action of waſte againſt him that holds lands for life or years; and by the equity thereof, a man ſhall have action of waſte againſt a tenant that holds but for one year, or one half-year, which is without the words of the act, but within the meaning of it; and the words that enact the one, by *equity* enact the other. So that equity is of two kinds. The one abridges and takes from the letter of the law; the other enlarges and adds to it: and ſtatutes may be conſtrued according to equity, eſpecially where they give remedy for wrong, or are for expedition of juſtice. Equity ſeems to be the interpoſing *law of reaſon*, exerciſed by the lord chancellor in extraordinary matters to do equal juſtice; and by ſupplying the defects of the law, gives remedy in all caſes. See CHANCERY.

EQUITY, in *Mythology*, ſometimes confounded with *Juſtice*, a goddeſs among the Greeks and Romans, repreſented with a ſword in one hand and a balance in the other.

EQUIVALENT, is underſtood of ſomething that is equal in value, force, or effect, to another.

Equivalence is of various kinds, in propoſitions, in terms, and in things.

EQUIVALENT Propoſitions. See EQUIPOLLENCE.

EQUIVALENT Terms, are where ſeveral words that differ in ſound have yet one and the ſame ſignification; as *every body was there*, and *nobody was abſent*, *nihil non*, and *omne*.

EQUIVALENT Things, are either *moral*, *phyſical*, or *ſtatical*. *Moral*, as when we ſay that the commanding or adviſing a murder is a guilt equivalent to that of the murderer. *Phyſical*, as when a man who has the ſtrength of two men is ſaid to be equivalent to two men. *Statical*, whereby a leſs weight becomes of equal force with a greater, by having its diſtance from the centre increaſed.

EQUIVOCAL TERMS or WORDS, among logicians, are thoſe which have a doubtful or double meaning.

According to Mr Locke, the doubtfulneſs or uncertainty of words has its cauſe more in the ideas themſelves, than in any incapacity of the words to ſignify them; and might be avoided, would people always uſe the ſame term to denote the ſame idea or collection of ideas: but, adds he, it is hard to find a diſcourſe on any ſubject where this is the caſe; a practice which can only be imputed to folly or great diſhoneſty; ſince a man, in making up his accounts, might with as much fairneſs uſe the numerical characters ſometimes for one ſometimes for another collection of units.

EQUIVOCAL Generation, the production of animals without the intercourſe between the ſexes, by the influence of the ſun or ſtars, &c.

This kind of generation is now quite exploded by the learned.

EQUIVOCATION, the uſing a term or expreſſion that has a double ſignification. Equivocations are expedients to ſave telling the truth, and yet without telling a falſity. The fathers are great patrons of equivocations and mental reſervations, holding that the uſe of ſuch ſhifts and ambiguities is in many caſes allowable.

EQUULEUS, or ECCULEUS, in antiquity, a kind of rack uſed for extorting a confeſſion; at firſt chiefly practiſed on ſlaves, but afterwards made uſe of againſt the Chriſtians. Equuleus || Eraſmus.

The equuleus was made of wood, having holes at certain diſtances, with a ſcrew by which the criminal was ſtretched to the third, ſometimes to the fourth or fifth holes, his arms and legs being faſtened on the equuleus with cords; and thus was hoiſted aloft, and extended in ſuch a manner, that all his bones were diſlocated. In this ſtate red-hot plates were applied to his body, and he was goaded in the ſides with an inſtrument called an *ungula*.

EQUULEUS, EQUICULUS, and *Equus Minor*, the horſe's head, in *Aſtronomy*, a conſtellation of the northern hemiſphere, whoſe ſtars in Ptolemy's catalogue are four, in Tycho's four, in Hevelius's ſix, and in Mr Flamſteed's ten.

EQUUS, a genus of quadrupeds belonging to the claſs mammalia, and order of belluæ. See MAMMALIA *Index*. And for the diſeaſes of the horſe, ſee FARRIERY *Index*.

ERA, in *Chronology*. See ÆRA.

ERANARCHA, a public officer among the ancient Greeks, whoſe buſineſs was to preſide over and direct the alms and proviſions made for the poor. Cornelius Nepos, in his life of Epaminondas, deſcribes his office thus: When any perſon was reduced to poverty, taken captive, or had a daughter to marry, which he could not effect for want of money, &c. the eranarcha called an aſſembly of friends and neighbours, and taxed each according to his means and eſtate, to contribute towards his relief.

ERANTHEMUM, a genus of plants belonging to the diandria claſs. See BOTANY *Index*.

ERASISTRATUS, a celebrated phyſician, grandſon to the philoſopher Ariſtotle. He diſcovered by the motion of the pulſe the love which Antiochus had conceived for his mother-in-law Stratonice, and was rewarded with 100 talents for the cure by the father of Antiochus. He was great enemy to bleeding and violent phyſic.

ERASMUS, DESIDERIUS, born at Rotterdam in 1467. He loſt his father and mother at 14 years of age; and was committed to the care of a certain guardians, who would force him to be an eccleſiaſtic, which he refuſed for a long time. However, he was obliged to aſſume the religious habit among the canons regular in the monaſtery of Stein near Tergou; but afterwards obtained a diſpenſation from his vows. He was the moſt learned man of the age in which he lived; and contributed, by his example and his writings, to the reſtoration of learning in the ſeveral countries in which he occaſionally reſided, viz. Italy, Switzerland, Holland, France, and England: with the laſt, he was moſt ſatisfied; and found the greateſt encouragement from Henry VIII. Sir Thomas More, and all the learned Engliſhmen of thoſe days. He publiſhed a great many books; and died at Baſil in 1536. He was buried honourably, and his memory is ſtill held in veneration. He had, however, many enemies; and as he did not embrace the reformation, and yet cenſured many things in popery, he hath been treated injuriouſly both by Catholics and Proteſtants. The works of Eraſmus in 10 vols folio were publiſhed at Leyden

in

Erastians || Erection.

in 1706, in a very handſome manner, under the care of M. le Clerc. Dr Jortin publiſhed his life in one vol. 4to, 1758.

ERASTIANS, a religious ſect or faction which aroſe in England during the time of the civil wars in 1647, thus called from their leader Thomas Eraſtus, whoſe diſtinguiſhing doctrine it was, that the church had no right to diſcipline, that is, no regular power to excommunicate, exclude, cenſure, abſolve, decree, or the like.

ERATO (from ἐραω, *I love*), in *Mythology*, the name of one of the nine muſes, who preſided over love-poetry. To this muſe ſome have aſcribed the invention of the lyre and lute; and ſhe is repreſented with a garland of myrtles and roſes, holding a lyre in one hand and a bow in the other, and at her ſide a Cupid with his torch. There is alſo a Nereid of the ſame name.

ERATOSTHENES, a Cyrenæan philoſopher, hiſtorian, and poet; called for his learning *Plato Minor*. He was keeper of the famous library at Alexandria; and was greatly in favour with Ptolemy Euergetes, by whoſe order he wrote a hiſtory of the Theban kings of Egypt, which ſucceſſion was entirely omitted by Manetho. He thus fixed the Egyptian chronology, and his authority is by many preferred to that of Manetho. He wrote many other things, a catalogue of which is to be ſeen in Fabricius, Voſſius, &c. but his only piece now remaining entire is a deſcription and fabulous account of the ſtars. He ſtarved himſelf in old age through grief for the dimneſs of his ſight, about the 10th or 12th year of Ptolemy Epiphanes, 194 B. C.

ERATOSTRATUS, an Epheſian who burnt the famous temple of Diana the ſame night that Alexander the Great was born. This burning, as ſome writers have obſerved, was not prevented or ſeen by the goddeſs of the place, who was then preſent at the labour of Olympias, and at the birth of the conqueror of Perſia. Eratoſtratus did this villany merely to eternize his name by ſo uncommon an action.

EREBUS (Ἔρεβος, from ערב *night*), in *Mythology* a term denoting darkneſs. According to Heſiod, Erebus was the ſon of Chaos and the night, and the father of the day. This was alſo the name of part of the *inferi* among the ancients: they had a peculiar expiation for thoſe who were detained in Erebus.

Erebus was properly the gloomy region, and diſtinguiſhed both from Tartarus the place of torment, and Elyſium the region of bliſs: according to the account given of it by Virgil, it forms the third grand diviſion of the inviſible world beyond the Styx, and comprehends ſeveral particular diſtricts, as the *limbus infantum*, or the receptacle for infants; the *limbus* for thoſe who have deſtroyed themſelves; the fields of mourning, full of dark groves and woods, inhabited by thoſe who died for love; and beyond theſe, an open champaign country for departed warriors.

ERECTION, in a general ſenſe, the act of raiſing or elevating any thing; as the erection of a perpendicular, &c. It is alſo uſed in a figurative ſenſe; as the erection of a biſhop, marquiſate, &c.

ERECTION is particularly uſed by medical writers for the ſtate of the penis when ſwelled and diſtended by the action of the muſcles called *erectores*. See ANATOMY *Index*.

There is alſo an erection of the clitoris, which is performed by muſcles for that purpoſe.

Eremit || Eretna.

EREMIT. See HERMIT.

ERETRIA, in *Ancient Geography*, a town of Eubœa, ſituated on the Euripus, in the ſouth-weſt of the iſland. A very ancient city, and the largeſt of the iſland, after Chalcis. After being demoliſhed by the Perſians, it was reſtored on an adjoining ſpot, according to Strabo, who mentions a ſchool of Etrurian philoſophers there. The Abantes of Homer were of Eubœa.

ERFORT, a town of Germany, in the circle of Upper Saxony, the capital of Thuringia, and ſubject to the elector of Mentz. It is defended by good ramparts; and has a caſtle on an eminence, which commands the town. Its inhabitants are almoſt all Lutherans, but its principal churches belong to the Catholics. There are ſeveral handſome ſtructures, both public and private; but the houſes in general are but indifferently built. E. Long. 11. 14. N. Lat. 50. 49.

ERGASTULUM, among the Romans, was a priſon, work-houſe, or houſe of correction, where ſlaves by the private authority of their maſters were confined and kept for their offences to hard labour. The Greeks had a place of confinement of this ſort called Σωφρονιστηριον.

ERGOT, in *Farriery*, is a ſtub, like a piece of ſoft horn, about the bigneſs of a cheſnut, placed behind and below the paſtern joint, and commonly hid under the tuft of the fetlock. See FARRIERY *Index*.

ERICA, HEATH, a genus of plants belonging to the octandria claſs, and in the natural method ranking under the 18th order, *Bicornes*. See BOTANY *Index*.

ERIDANUS, in *Ancient Geography*, a river of Attica, falling into the Iliſſus.—Another Eridanus, the more ancient name of the Padus, an appellation aſcribed by Pliny to the Greeks; followed in this by Virgil. It riſes in Mount Veſulus, in the Alpes Cottiæ, and dividing the Ciſalpine Gaul into the Ciſpadana and Tranſpadana, and ſwelled on each hand with no inconſiderable rivers from the other Alps and the Apennine, falls at ſeven mouths into the Adriatic. Famous in mythology, from the ſtory of Phaëton; whoſe ſiſters, the Heliades, were here changed into poplars, according to Ovid.

ERIDANUS, in *Aſtronomy*, a conſtellation of the ſouthern hemiſphere, in form of a river.—The ſtars in the conſtellation Eridanus, in Ptolemy's catalogue, are 34; in Tycho's, 19; and in the Britiſh catalogue, 84.

ERIE, a vaſt lake to the weſtward of Pennſylvania, in North America, ſituated between 80° and 87° W. Long. and between 41° and 42° N. Lat.

ERIGENA, or SCOTUS, JOHN, a famous ſcholaſtic divine, born about the beginning of the ninth century; but where, is a matter of diſpute among authors. Bale and Pits ſays he was born at St David's in Wales; Dempſter, Mackenzie, and Henry, that he was born at Ayr in Scotland; which they infer from his names *Erigena* and *Scotus*, by the latter of which he was generally diſtinguiſhed by his cotemporary writers. But Du Pin and Sir James Ware aſſert that he was by birth an Iriſhman; Ireland being in thoſe days called *Scotia*,

Erigena. and by the natives *Erin*. They agree, however, in relating that he travelled to Athens, where he acquired a competent knowledge of the Greek and other oriental languages; and that he afterwards reſided many years in the court of Charles the Bald, king of France, who, on account of his ſingular abilities, treated him as his intimate friend and companion. He ſlept frequently in the royal apartment; and was conſtantly admitted to the king's table. "We may judge (ſays a modern hiſtorian) of the freedom which he uſed with Charles, by the following repartee. As the king and Scotus were ſitting one day at table, oppoſite to each other, after dinner, drinking a cheerful glaſs, the philoſopher having ſaid ſomething that was not quite agreeable to the rules of French politeneſs, the king in a merry humour aſked him, Pray what is between a *Scot* and a *ſot*? To which he anſwered, "Nothing but the table." See *Henry's Hiſtory of Great Britain*, vol. i. p. 344. who quotes this ſtory from *Hovedeni Annal. ad an.* 86. Quer. What language were they talking when this *bon mot* was uttered?

During his reſidence with Charles, he wrote ſeveral books of ſcholaſtic divinity; which, though abſurd enough, were at that time not ſufficiently ſo to ſecure him from the imputation of heterodoxy; and on that account the pope commanded Charles the Bald to ſend him to Rome; but the king had too great a regard for his companion to truſt him with his Holineſs. One of the chief controverſies in which Scotus was engaged, and with which the pope was much offended, was concerning the real preſence and blood of Chriſt in the wafer. His opinion of this weighty matter is expreſſed in theſe few words: "What we receive corporally is not the body of our Lord; but that which feeds the ſoul, and is only perceived by faith." He was alſo engaged in two other controverſies of equal importance, but of a ſomewhat leſs delicate nature. The firſt was, Whether any part of the euchariſt be evacuated by ſtool? and the ſecond, Whether Chriſt was born of the Virgin Mary *aperta vulva*; Paſchaſius was of opinion, that this could not be without ſome injury to her perpetual virginity; and therefore believed that Chriſt came into the world *per vulvam clauſam*, as he came into the place where his diſciples were aſſembled, through the door and not through the wall, without opening the door. Concerning the firſt of theſe delicate queſtions, Scotus with ſeveral others declared, that part of the euchariſt was certainly evacuated by ſtool; for which they were honoured with the appellation of *Stercoriſts*. And as to the ſecond queſtion, he ſaid, that the *vulva clauſa* was a dangerous opinion: for it would thence follow, that he was not born, but iſſued; *non eſt naſci, ſed erumpi*. See Mackenzie, vol. i. p. 55.

Whether this John Scotus returned to England, or ended his days in France, is a matter of doubt. Some of our hiſtorians tell us, that he left France in the year 864; and that, after reſiding about three years in Oxford, he retired to the abbey of Malmſbury, where his ſcholars ſtabbed him with their pen knives. There is no foundation for this ſtory. Probably he died about the year 874; but whether in France or England, is uncertain,, and of little importance. Some have related, that he was invited to England by King Alfred: but in this they confound him with John, abbot of Etheling, who was aſſaſſinated in 895; and to this miſtake the various accounts concerning this author are to be attributed. Regardleſs of his hiſtory, he appears from his writings to have been a man of parts, and, in point of learning, ſuperior to any of his cotemporaries. He wrote, 1. *De diviſione naturæ*, lib. v. 2. *De prædeſtinatione Dei*. 3. *Excerpta de differentiis & ſocietatibus Græci Latinique verbi*. 4. *De corpore et ſanguine Domini*. 5. *Ambigua S. Maximi, ſeu ſcholia ejus in difficiles locos S. Gregorii Nazianzeni, Latinè verſa*. 6. *Opera S. Dionyſii quatuor in Latinam ling. converſa*. All publiſhed. 7. *De viſione Dei*, and ſeveral other works, in manuſcript, preſerved in different libraries.

Erigeron || Erivan.

ERIGERON, FLEA-BANE, a genus of plants, belonging to the ſyngeneſia claſs; and in the natural method ranking under the 49th order, *Compoſitæ*. See BOTANY *Index*.

ERIGONE, in fabulous hiſtory, daughter to Icarius, died of grief for her father's death, was tranſlated into heaven, and makes the ſign Virgo.

ERINACEUS, or HEDGE-HOG, a genus of quadrupeds belonging to the order of feræ, in the claſs mammalia. See MAMMALIA *Index*.

ERINGO. See ERYNGIUM, BOTANY *Index*.

ERINUS, a genus of plants belonging to the didynamia claſs; and in the natural method ranking under the 40th order, *Perſonatæ*. See BOTANY *Index*.

ERIOCAULON, a genus of plants, belonging to the triandria claſs; and in the natural method ranking with the ſixth order, *Enſatæ*. See BOTANY *Index*.

ERIOCEPHALUS, a genus of plants, belonging to the ſyngeneſia claſs; and in the natural method ranking under the 49th order, *Compoſitæ*. See BOTANY *Index*.

ERIOPHORUM, a genus of plants, belonging to the triandria claſs; and in the natural method ranking under the third order, *Calamariæ*. See BOTANY *Index*.

ERITHALIS, a genus of plants, belonging to the pentandria claſs; and in the natural method ranking with thoſe of which the order is doubtful. See BOTANY *Index*.

ERIVAN, a city of Perſia, in Aſia, and capital of Perſian Armenia. It is a large, dirty, ill-looking place, in which are no handſome buildings, the houſes being very mean, and raiſed with earth or mud; but it is full of gardens and vineyards. It is ſituated in a plain which is ſurrounded on all ſides with mountains. Two rivers paſs near it, the Zengui to the north-weſt, and the Queur Boulac to the ſouth-weſt. The fortreſs may paſs for a town of itſelf; it is of an oval form, and is four miles in circumference, containing about 800 houſes. It is inhabited by none but the native Perſians. The Armenians have ſhops in it, where they work and trade in the day time, but at night return to their habitations in the city. The fortreſs is ſurrounded with three walls, made with bricks dried in the ſun, which have battlements, and are flanked with towers, and defended with ramparts. On the north-eaſt there is a dreadful precipice, above 200 yards in depth, at the bottom of which the river runs. The garriſon uſually conſiſted of 2000 men; but how many there are ſince the revolution is hard to ſay. The palace of the govenor of the province is within the fortreſs. The city is-

Eriphyle ‖ Ermin.

is about a cannon's ſhot diſtant from the fortreſs, and the ſpace between is full of houſes and markets. E. Long. 44. 50. N. Lat. 40. 20.

ERIPHYLE, in fabulous hiſtory, a ſiſter of Adraſtus king of Argos, who married Amphiaraus. She was daughter of Talaus and Liſimache. When her huſband concealed himſelf that he might not accompany the Argives in their expedition againſt Thebes, where he knew he was to periſh, Eriphyle ſuffered herſelf to be bribed by Polynices with a golden necklace which had been formerly given to Hermione by the goddeſs Venus, and ſhe diſcovered where Amphiaraus was. This treachery of Eriphyle compelled him to go to the war; but before he departed, he charged his ſon Alcmæon to murder his mother as ſoon as he was informed of his death. Amphiaraus periſhed in the expedition; and his death was no ſooner known than his laſt injunctions were obeyed, and Eriphyle was murdered by the hands of her ſon.

ERIS, the goddeſs of diſcord among the Greeks. She is the ſame as the *Diſcordia* of the Latins.

ERISICHTHON, in fabulous hiſtory, a Theſſalian, ſon of Triops, who derided Ceres and cut down her groves. This impiety irritated the goddeſs, who afflicted him with continual hunger. He ſquandered all his poſſeſſions to gratify the cravings of his appetite, and at laſt he devoured his own limbs for want of food. Some ſay that his daughter had the power of transforming herſelf into whatever animal ſhe pleaſed, and that ſhe made uſe of that artifice to maintain her father, who ſold her, after which ſhe aſſumed another ſhape, and became again his property.

ERMIN. See MUSTELA, MAMMALIA *Index*.

ERMIN, or *Ermine*, in *Heraldry*, denotes a white field or fur, powdered or interſperſed with black ſpots, called *powdering*. It is ſuppoſed to repreſent the ſkin of an animal of the ſame denomination. There is however no animal whoſe ſkin naturally correſponds to the herald's ermin.

The animal is milk white; and ſo far is it from having ſpots, that tradition reports, that it will rather die or be taken than ſully its whiteneſs. Whence its ſymbolical uſe.

But white ſkins having for many ages been uſed for the linings of the robes of magiſtrates and great men; the furriers at length, to add to their beauty, uſed to ſew bits of the black tails of thoſe creatures upon the white ſkins, to render them the more conſpicuous. Which alteration was introduced into armoury.

The fable ſpots in ermin are not of any determinate number, but they may be more or leſs at the pleaſure of the painter or furrier.

ERMIN, an order of knights, inſtituted in 1450 by Francis I. duke of Bretagne, and formerly ſubſiſting in France. The collar of this order was of gold, compoſed of ears of corn in ſaltier; at the end of which hung the ermin, with this inſcription, *à ma vie*. But the order expired when the dukedom of Bretagne was annexed to the crown of France.

Ermines ‖ Erpenius.

ERMINES, in *Heraldry*, the reverſe of ermine, i. e. white ſpots on a black field.

ERMINITES, in *Heraldry*, ſhould ſignify little ermines, but it is otherwiſe; for it ſignifies a white field powdered with black, only that every ſuch ſpot hath a little red hair on each. Erminites alſo ſignify a yellow field powdered with black, which the French expreſs much better by *or ſemée d'ermine de ſable*.

ERMINOIS, in *Heraldry*, ſignifies the field or, and the ſpots black.

EROORO. See ALCEDO, ORNITHOLOGY *Index*.

EROS, (of ἐρως "love"), in *Mythology*, one of two chiefs over all the other Cupids, being the cauſe of love. See ANTEROS.

EROTIA, a feſtival in honour of Eros the god of love. It was celebrated by the Theſpians every fifth year with ſports and games, when muſicians and others contended. If any quarrels or ſeditions had ariſen among the people, it was then uſual to offer ſacrifices and prayers to the god, that he would totally remove them.

EROTIC (derived from ἐρως "love;" whence ἐρωτικος), is applied to any thing which has a relation to the paſſion of love.

In medicine we find the phraſe *delirium eroticum* uſed for a kind of melancholy contracted through exceſs of love.

EROSION, among phyſicians, denotes much the ſame with CORROSION, only in a ſtronger degree.

EROTESIS. See ORATORY, N° 94.

ERPENIUS, THOMAS, in Dutch THOMAS of ERPE, a celebrated profeſſor of the Arabic language, was born at Gorcum in Holland in 1584, and educated at Leyden. He applied himſelf to the oriental languages at the perſuaſion of Joſeph Scaliger; and afterwards travelled into England, France, Italy, and Germany, and everywhere obtained the eſteem of the learned. On his return to Holland, he was made profeſſor of Arabic in the univerſity of Leyden, and died there in 1624. He publiſhed a great many excellent works, which ſpread his reputation through the whole learned world. It is ſaid, that the king of Morocco admired ſo greatly the letters of Erpenius wrote to him in Arabic in the name of the United Provinces, that he could not ceaſe reading them, and ſhowing them to thoſe who ſpoke that language naturally.

ERPETOLOGY.

INTRODUCTION.

THE animals of which we propoſe, under the general title *Erpetology*, to give the claſſification and natural hiſtory, belong to the claſs *Amphibia*, and the order *Reptilia*, in the Linnæan arrangement. The animals included under this claſs have obtained the denomination of amphibious, from the ſuppoſed circumſtance that they are equally capable of living, both on land and in the water. But in this view, the application of the term is inaccurate, for there are few, or perhaps no animals belonging to this claſs which can always exiſt,

or even perform the functions of life for any conſiderable length of time, in the water. Many of them, however, poſſeſs this faculty to a certain degree, and therefore, the name has been extended to all which are diſtinguiſhed by the ſame peculiarity of external form, and a ſimilar ſtructure of internal organs.

Some naturaliſts have denominated this order of animals *oviparous quadrupeds*. This denomination is undoubtedly ſufficiently characteriſtic; for although ſome ſpecies are viviparous, and in this circumſtance, as well as being furniſhed with four feet, exhibit ſome reſemblance with the higher order of quadrupeds, the ſtriking difference which is diſcovered by the anatomiſt and the phyſiologiſt, affords unequivocal and decided marks of diſtinction. From the ſtructure, habits, and general economy of this order of animals, we derive characters which are ſufficiently diſtinctive between it and the claſs of birds, to which the term *oviparous* is ſtrictly applicable. This denomination, therefore, which is alſo employed by the Count de la Cepede, is ſufficiently characteriſtic of the claſs of animals which are included under it.

The word *reptile*, by which this order of animals has been diſtinguiſhed by Linnæus, ſeems not to be liable to much objection. All the individuals of which it is compoſed have very ſhort legs, and theſe are placed at a great diſtance from each other, and ſo weak, that they are unable to ſupport the weight of the body. The gray lizard, for inſtance, which is one of the moſt active of the tribe, is obliged to ſupport itſelf on its belly, as ſoon as its progreſſive motion is greatly diminiſhed; ſo that it employs its limbs rather for the purpoſe of crawling than that of walking. And indeed all the animals of the order, from the peculiar ſtructure and diſpoſition of their limbs, when their motions are ſlow, muſt drag the body along on the belly, other modifications of their locomotive powers depending only on the great length and relation of the inſtruments of motion. In this view, therefore, the Linnæan name of the order is not improperly applied to almoſt all the individuals which it comprehends.

The term *erpetology*, which we have given to this treatiſe upon the order *reptilia*, was formerly employed by the Swediſh naturaliſt Klein, in a more extenſive ſenſe. Under this title he included the order *ſerpentes*, as well as that of *reptilia*, thus comprehending the whole claſs of *amphibia*. Here we have adopted it in a more limited acceptation, and confined its meaning to the laſt order, purſuing the plan of M. Bonnaterre, in his arrangement of the ſame order of animals in the Encyclopedie Methodique.

Linnæus has adopted as a mark of diſtinction of this order of animals, the peculiar ſtructure of the heart, which in the language of the anatomiſt is ſaid to be *unilocular*, or furniſhed only with one ventricle or cavity. This doctrine has been admitted by eminent anatomiſts, as well as by ſome of the greateſt phyſiologiſts, ſuch as Boerhaave, Haller, and ſome others; and called in queſtion only when ſome exceptions have occurred, of animals belonging to this tribe, which have exhibited ſomewhat of a different ſtructure. One inſtance of this is quoted in the heart of an Indian inland tortoiſe, which was examined by the French academicians of the 17th century, and in which they diſcovered three ventricles inſtead of one. But other phyſiologiſts are of opinion, that the heart of this order of animals is really furniſhed with two ventricles, having an immediate communication between them; they muſt therefore be conſidered as having a double heart.

The lungs of the order *reptilia* are, in their appearance and ſtructure, widely different from thoſe of other animals. They are in general compoſed of two large bladders, or membranaceous bags, which, in the different ſpecies are divided into a greater or ſmaller number of *cancelli*, or ſubdiviſions; among which are diſtributed the pulmonary blood-veſſels. Theſe bear but a ſmall proportion to the veſicular part through which the ramifications are carried; in this reſpect differing greatly from the lungs of the higher order of quadrupeds, or *mammalia*, in which the proportion of the blood-veſſels is ſo much greater than that of the air-cells, that the lungs have more of a fleſhy than of a membranaceous appearance. In this order of animals, therefore, in which the blood is cold, the veſicular ſyſtem far overbalances the vaſcular; but in the claſs *mammalia*, which are warm-blooded animals, the vaſcular ſyſtem prevails over the veſicular.

Of all the animals which occupy the ſurface of the earth, and which the Almighty Creator has diſperſed throughout his works, to fill up the void of ſpace, and to produce motion, the tribe of reptiles ſeems at firſt ſight to have been leaſt the objects of beneficence and wiſdom. In their ſtructure, habits, and mode of life, when compared with other orders of animals, they exhibit marks of degradation and neglect. The body in general preſents only a rude inactive maſs; their ſenſes are extremely obtuſe; their inſtincts are limited to the groſſeſt ſenſations, and the extent of their enjoyments reaches only to the gratifications of appetite. On the boundaries of land and water, in thoſe vaſt moraſſes, which are remarkable only for immenſe depoſitions of mud, few or ſcarcely any poſſeſs the graces or elegance of other terreſtrial animals; like the latter they enjoy not the pleaſure of aſſociating together for amuſement or defence, or of indulging in ſportive tricks on the land, or in the air. On the contrary, they crawl on the earth, on the margin of extenſive lakes, ſurrounded with unwholeſome vapours; or they live in the cavities of the rocks, or in the midſt of barren deſerts, undiſturbed by other animals, and far retired from the habitations of man. Some delight in expoſing themſelves to the rays of the ſun; while others retire during the day to ſhady, moiſt, and ſequeſtered places, proceeding from their retreats only during the night, as it were to conceal their deformity, and to ſpare man thoſe feelings of fear, diſguſt, and horror, with which their preſence inſpires him. But as the ſtudy of every part of the long chain of beings is worthy of our attentive conſideration and regard, theſe animals, in the eyes of the careful obſerver of nature, are far from being wanting in exciting his intereſt and curioſity. He cannot fail to be highly gratified with contemplating the reſources which they derive from the peculiar ſtructure of their external form, as well as from the nature of their functions. Their manners, their habits, and the relations which they bear to beings of a higher order, on the one hand, and the diſtance to which they are removed from brute matter on the other, are objects worthy of the contemplation of the naturaliſt. This ſtudy, properly directed and applied, unveils to our eyes the beneficent

deſign

deſign and riches of creation, and raiſes our admiration to the wonderful and extenſive variety of animated beings.

The uſes of ſome of the animals belonging to this claſs, as valuable articles of food in thoſe regions where they abound, or as furniſhing the tables of the luxurious in other countries with a rich delicacy; the peculiarities of external form, and of internal ſtructure, as well as of ſeveral of their functions, ſuch as circulation and reſpiration; their great length of life; the reproductive power of ſome, and the long abſtinence which others can undergo, give additional intereſt and importance to the natural hiſtory of theſe animals.

In the following treatiſe, we propoſe to lay before our readers a brief but comprehenſive view of the natural hiſtory of this order of animals; and for the ſake of perſpicuity we ſhall treat this ſubject under two general heads. We ſhall firſt conſider the claſſification and natural hiſtory of the order *reptilia*; and ſecondly, we ſhall give a ſhort ſketch of their anatomy, with the principal facts connected with their phyſiology. Theſe will form the ſubjects of the two following chapters.

CHAP. I. OF THE CLASSIFICATION AND NATURAL HISTORY OF REPTILES.

In the Linnæan arrangement, the order *reptilia* is divided into four genera. Other naturaliſts have adopted a different arrangement. De la Cepede, in his hiſtory of oviparous quadrupeds, has divided this order into two great claſſes. The firſt claſs includes thoſe animals which are furniſhed with a tail, and the ſecond comprehends thoſe which have no tail. The following table exhibits a view of the claſſification of this eminent naturaliſt.

Claſs I. Animals furniſhed with a tail.
- Genus 1. *Tortoiſes*, having the body covered with a bony ſhield.
  - Diviſion 1. The fingers very unequal, and lengthened out in the form of fins.
  - Diviſion 2. The fingers very ſhort, and almoſt equal.
- Genus 2. *Lizards*: the body having no bony covering.
  - Diviſion 1. The tail flattened; five fingers on the fore feet.
  - Diviſion 2. The tail round; five fingers on each foot, and elevated ſcales on the back.
  - Diviſion 3. The tail round; five fingers on the fore feet: ſcaly bands under the belly.
  - Diviſion 4. The tail round; five fingers on the fore feet, without ſcaly bands under the belly.
  - Diviſion 5. The fingers furniſhed underneath with large ſcales, covering each other, like the ſlates on the roof of a houſe.
  - Diviſion 6. Three fingers on the fore and the hind feet.
  - Diviſion 7. Membranes in the form of wings.
  - Diviſion 8. Three or four fingers on the fore feet; four or five fingers on the hind feet.

Claſs II. Animals which have no tail.
- Genus 1. *Frogs*: the head and the body lengthened out, and the one or the other angular.
- Genus 2. *Tree-frogs*: the body long, with ſoft viſcid tubercles under the toes.
- Genus 3. *Toads*: the body thick and round.
- Appendix. Biped reptiles.
  - Diviſion 1. Two fore feet.
  - Diviſion 2. Two hind feet.

Of this arrangement it may be obſerved, that, although it exhibits much minuteneſs and ingenuity, the diſtinctive characters upon which ſome parts of it are founded, are not always conſtant and fixed; for it has been found that theſe characters vary in the different individuals in which they have been obſerved. This variety, it has been conjectured, ariſes from the difference of age, and peculiarities in their food and modes of life.

M. Bonnaterre has adopted a different arrangement. He has alſo divided the whole order of reptiles into two claſſes, as will appear from the following table.

Claſs I. Reptiles which have no tail.
- Genus 1. *Frog.*
- Genus 2. *Tree-Frog.*
- Genus 3. *Toad.*

Claſs II. Reptiles which are furniſhed with a tail.
- Genus 1. *Tortoiſe.*
- Genus 2. *Chamelion.*
- Genus 3. *Crocodile.*
- Genus 4. *Lizard.*
- Genus 5. *Flying dragon.*
- Genus 6. *Salamander.*
- Genus 7. *Chalcis.*

This arrangement is undoubtedly, in many caſes, convenient and proper; yet, as there ſeems to be in others an unneceſſary multiplication of genera, we ſhall ſtill adhere to the Linnæan claſſification, which, though more ſimple, will in general be found not to be much leſs accurate; and the objects which it comprehends not being very numerous, it is ſufficiently diſtinct. Linnæus divided this order into four genera. The following are the characters of the genera, of which we give a tranſlation, for the accommodation of the Engliſh reader.

GENERIC CHARACTERS.

Genus I. Testudo. Corpus caudatum; lorica oſſea, aut coriacea ſuperne et infernè, vel ſquamis ſuperne obtectum. Oris mandibula ſuperior inferiorem pyxidum inſtar claudens.

Genus I. Tortoise. Body having a tail: covered above and beneath with a bony or coriaceous ſhell, or ſcales above. The upper jaw cloſing over the lower like the lid of a box.

Genus II.

Tortoiſes. Genus II. Rana. Corpus tetrapodum, nudum, utplurimum ecaudatum: pedibus poſterioribus longioribus.

Genus III. Draco. Corpus tetrapodum, caudatum, alatum: alis propriis.

Genus IV. Lacerta. Corpus tetrapodum, elongatum, caudatum, nudum: pedibus æqualibus.

Tortoiſes. Genus II. Frog. Body four-footed, naked, generally without tail; the hinder feet longeſt; *and without any integument but the ſkin.*

Genus III. Flying Dragon. Body four-footed, furniſhed with a tail, and on each ſide with an expanſile wing-like ſkin.

Genus IV. Lizard. Body four-footed, elongated, furniſhed with a tail, without any additional integument: legs equal.

I. TESTUDO, or Tortoise.

From the great ſimilarity which prevails among ſeveral ſpecies, and the variety in ſize, colour, and other circumſtances, according to the different periods of their age, conſiderable difficulties have ariſen in diſcriminating them with preciſion. The obſervations of later naturaliſts have ſhown, that the ſpecific characters of Linnæus are not ſufficient for the purpoſe of accurate diſtinction; nor have the deſcriptions of the Count de la Cepede been more uſeful in furniſhing proper characteriſtic marks. One ſet of characters, which have been uſually employed for this purpoſe, it has been obſerved by Mr Schoepff, ought not be truſted. They are derived from the number of claws on the feet of marine tortoiſes, or turtles. Theſe, however, are found to vary ſo much, that they are not to be conſidered as affording uniform and conſtant characters of diſtinction. As a proof of this obſervation, if different individuals of the common green turtle (*teſtudo midas*), be compared together, it will appear that ſome have only a ſingle claw on each foot; while others are furniſhed with two, and ſometimes three; ſometimes with two on the fore feet, and with one on the hind feet. Similar variations have alſo been obſerved in the number of claws of land tortoiſes, and particularly in thoſe of the common tortoiſe, (*teſtudo græca*); in ſome individuals of which the fore feet have four, and in others five claws. Avoiding, therefore, theſe uncertain and varying characters, the ſhape, pattern, colours of the ſhell, and form of the head, Dr Shaw obſerves, furniſh the moſt accurate marks of diſtinction.

Some of the ſpecies belonging to this genus are natives of the ocean; ſome are confined to the land, or to freſh water. This affords a natural diviſion into land and ſea tortoiſes. In following out this diviſion, we ſhall treat of them in two ſections, including under the firſt thoſe that frequent freſh waters.

Sect. I. *Land and Freſh-water Tortoiſes.*

1. Testudo Græca. Lin. *Common Land Tortoiſe.*

Specif. Char.—The ſhell is hemiſpherical, and of a black and yellow colour, and having a bunch behind; the pieces of which the diſk is compoſed are convex, and the ſides are obtuſe.

Deſcription. The length of the common tortoiſe is about ſix inches, and rarely exceeds eight: when full grown, it is about forty-eight ounces weight. The ſhell is compoſed of thirteen middle pieces, and about twenty-five marginal ones; is of an oval form, and very convex above. The middle pieces, or thoſe which conſtitute the diſk of the ſhield, are moſtly of a ſquare form, ſomewhat oblong; their colour is blackiſh or dark brown, each having a broad yellow band running along one ſide, which is continued half way along the upper part. The colours vary in different individuals, and the ſhape of the pieces is alſo ſubject to occaſional variations. The ſulci or furrows which appear on the ſurface of young animals are obliterated as they grow old. The belly part of the ſhell is of a pale yellow colour; the head is rather ſmall, the upper part covered with irregular tough ſcales, and the neck with ſmaller pieces, which admit of the motion of the head; the eye is ſmall and black, and the mouth does not extend beyond the eyes. The legs are ſhort; and the feet, which are moderately broad, are covered with ſtrong ovate ſcales. The feet have uſually four ſtout claws, but their number is found to vary in different circumſtances. The tail is rather ſhorter than the legs, is covered with ſmall ſcales, and terminates in a naked, horny, pointed tip.

Native country. The land tortoiſe is a native of almoſt all the countries round the Mediterranean; but it has been ſuppoſed to be more frequent in Greece, from whence it has derived its ſpecific name. It is alſo found in the iſlands of the Archipelago, in Corſica, Sardinia, and in many parts of Africa. From the account of the Daniſh naturaliſt Forſkal, it is employed in Greece for the purpoſe of food. "The inhabitants," he ſays, "often ſwallow the blood recent, and eat the eggs boiled, which are about the ſize of thoſe of a pigeon, four or five in number, and of a white colour. In September the animal hides itſelf under ground, and again emerges in February; laying its eggs in June, in a ſmall hole, which it ſcratches in ſome ſunny ſpot, out of which, after the firſt rains of September, the young are hatched, which are about the ſize of a walnut. The males of this ſpecies are ſaid to fight often, butting at each other with ſuch force, as to be heard at a conſiderable diſtance."

The land tortoiſe, when it is kept in gardens in Italy and Germany, is commonly obſerved to conceal itſelf in October, and to reappear in April. The period of retirement in England is about the end of October, and the time of its appearance is about the middle of April; but it ought to be added, that theſe periods vary in different countries, and according to the temperature of the ſeaſon.

Great age. The land tortoiſe lives to a very great age. In ſeveral inſtances which ſeem to be well authenticated, it has conſiderably exceeded the extraordinary period of an hundred years. One inſtance which is perhaps not the leaſt remarkable, is recorded of a tortoiſe which was introduced into the archbiſhop's garden at Lambeth.

Tortoises. beth, about the year 1633, and lived till the year 1753; the ſhell of which is ſtill preſerved in the library of the palace at Lambeth. Another remarkable circumſtance reſpecting this individual is, that it was of a larger ſize than uſual. The ſhell meaſured 10 inches in length, and ſix and a half in breadth.

Very tenacious of life. None of this orde of animals is more tenacious of life than the tortoiſe. The experiments of Redi afford a remarkable proof of this fact. In the beginning of November he made a large opening in the ſkull of a land tortoiſe, extracted the whole of the brain, waſhed out the cavity, that no part might remain; and having left the hole open, let the animal go. It walked off ſeemingly uninjured, excepting that it cloſed its eyes, which never afterwards opened. At the end of three days, during which time the whole of the ſkull began to cloſe, the wound was covered with a complete ſkin; and thus without brain it walked about as uſual, and lived for ſix months. The ſame naturaliſt cut off the head of another tortoiſe, which lived for the ſpace of twenty-three days afterwards.

Abſtinence This animal is not leſs remarkable for its abſtinence. Blaſius kept an individual of this ſpecies for ten months, during which time it taſted no kind of food whatever. It died about the end of that time, but this was aſcribed to the ſeverity of the ſeaſon, rather than to the want of food; for the inteſtines being examined, they were found full of excrement of the natural colour.

Mr White, in his Natural Hiſtory of Selborne, has given ſo full and diſtinct an account of the natural hiſtory of the land tortoiſe, founded on facts drawn from his own obſervation, that we ſhall lay it before our readers in his own words.

White's account of one. "A land tortoiſe (ſays he), which has been kept for thirty years in a little walled court belonging to the houſe where I now am viſiting, retires under ground about the middle of November, and comes forth again about the middle of April. When it firſt appears in the ſpring it diſcovers very little inclination towards food; but in the height of ſummer grows voracious: and then as the ſummer declines, its appetite declines; ſo that for the laſt ſix weeks in autumn, it hardly eats at all. Milky plants, ſuch as lettuces, dandelions, ſowthiſtles, are its favourite diſh. In a neighbouring village one was kept, till by tradition it was ſuppoſed to be an hundred years old. An inſtance of vaſt longevity in ſuch a poor reptile!

p. 135. "On the 1ſt of November, I remarked that it began firſt to dig the ground in order to the forming its hybernaculum, which it had fixed on juſt beſide a great tuft of hepaticas. It ſcrapes out the ground with its fore-feet, and throws it up over its back with its hind; but the motion of its legs is ridiculouſly ſlow, little exceeding the hour-hand of a clock; and ſuitable to the compoſure of an animal ſaid to be a whole month in performing one feat of copulation. Nothing can be more aſſiduous than this creature night and day in ſcooping the earth, and forcing its great body into the cavity; but, as the noons of that ſeaſon proved unuſually warm and ſunny, it was continually interrupted, and called forth by the heat in the middle of the day; and though I continued there till the thirteenth of November, yet the work remained unfiniſhed. Harſher weather, and froſty mornings, would have quickened its operations. No part of its behaviour ever ſtruck me more than the extreme timidity it always expreſſes with regard to rain; for though it has a ſhell that would ſecure it againſt the wheel of a loaded cart, yet does it diſcover as much ſolicitude about rain as a lady dreſſed in all her beſt attire, ſhuffling away on the firſt ſprinklings, and running its head up in a corner. If attended to, it becomes an excellent weather-glaſs; for as ſure as it walks elate, and as it were on tiptoe, feeding with great earneſtneſs in a morning, ſo ſure will it rain before night. It is totally a diurnal animal, and never pretends to ſtir after it becomes dark. The tortoiſe, like other reptiles, has an arbitrary ſtomach as well as lungs; and can refrain from eating as well as breathing for a great part of the year. When firſt awakened it eats nothing; nor again in the autumn before it retires: through the height of the ſummer it feeds voraciouſly, devouring all the food that comes in its way. I was much taken with its ſagacity in diſcerning thoſe that do it kind offices: for, as ſoon as the good old lady comes in ſight who has waited on it for more than thirty years, it hobbles towards its benefactreſs with awkward alacrity; but remains inattentive to ſtrangers. Thus not only "*the ox knoweth his owner, and the aſs his maſter's crib*," but the moſt abject reptile, and torpid of beings, diſtinguiſhes the hand that feeds it, and is touched with the feelings of gratitude!" Tortoiſes. *Ibid.* p. 148.

"The old Suſſex tortoiſe, (he adds), that I have mentioned ſo often, is become my property. I dug it out of its winter dormitory in March laſt, when it was enough awakened to expreſs its reſentments by hiſſing; and, packing it in a box with earth, carried it eighty miles in poſt-chaiſes. The rattle and hurry of the journey ſo perfectly rouſed it, that, when I turned it out on a border, it walked twice down to the bottom of my garden; however, in the evening, the weather being cold, it buried itſelf in the looſe mould, and continues ſtill concealed."

"As it will be under my eye, I ſhall now have an opportunity of enlarging my obſervations on its mode of life and propenſities; and perceive already that, towards the time of coming forth, it opens a breathing place in the ground near its head, requiring, I conclude, a freer reſpiration as it becomes more alive. This creature not only goes under the earth from the middle of November to the middle of April, but ſleeps great part of the ſummer; for it goes to bed in the longeſt days at four in the afternoon, and often does not ſtir in the morning till late. Beſides, it retires to reſt for every ſhower; and does not move at all in wet days."

"When one reflects on the ſtate of this ſtrange being, it is a matter of wonder to find that Providence ſhould beſtow ſuch a profuſion of days, ſuch a ſeeming waſte of longevity, on a reptile that appears to reliſh it ſo little as to ſquander more than two thirds of its exiſtence in a joyleſs ſtupor, and be loſt to all ſenſation for months together in the profoundeſt of ſlumbers."

"While I was writing, a moiſt and warm afternoon, with the thermometer at 50, brought forth troops of ſhell-ſnails; and, at the ſame juncture, the tortoiſe heaved up the mould, and put out its head; and the next morning came forth, as it were raiſed from the dead, and walked about till four in the afternoon. This was a curious coincidence! a very amuſing occurrence! to

ſee

Tortoises. Ibid. p. 261.

see such a similarity of feeling between the two τετρωκοι! for so the Greeks called both the shell-snail and the tortoise.

"Because we call this creature an abject reptile, we are too apt to undervalue his abilities, and depreciate his powers of instinct. Yet he is, as Mr Pope says of his lord,

——"Much too wise to walk into a well:"

and has so much discernment as not to fall down a kaha; but to stop and withdraw from the brink with the readiest precaution.

"Though he loves warm weather, he avoids the hot sun; because his thick shell, when once heated, would, as the poet says of solid armour, "scald with safety." He therefore spends the more sultry hours under the umbrella of a large cabbage-leaf, or amidst the waving forests of an asparagus-bed."

"But as he avoids heat in the summer, so, in the decline of the year, he improves the faint autumnal beams, by getting within the reflection of a fruit-wall: and, though he never has read that planes inclining to the horizon receive a greater share of warmth, he inclines his shell, by tilting it against the wall, to collect and admit every feeble ray.

"Pitiable seems the condition of this poor embarrassed reptile: to be cased in a suit of ponderous armour, which he cannot lay aside; to be imprisoned, as it were, within his own shell, must preclude, we should suppose, all activity and disposition for enterprise. Yet there is a season of the year (usually the beginning of June) when his exertions are remarkable. He then walks on tiptoe, and is stirring by five in the morning; and, traversing the garden, examines every wicket and interstice in the fences, through which he will escape if possible: and often has eluded the care of the gardener, and wandered to some distant field. The motives that impel him to undertake these rambles seem to be of the amorous kind: his fancy then becomes intent on

Ibid. p. 427.

sexual attachments, which transport him beyond his usual gravity, and induce him to forget for a time his ordinary solemn deportment."

2. Testudo Marginata, *Marginated Tortoise.*

Specif. Char.—The shell is blackish-brown, variegated with yellow, oblong, and gibbose, widened and depressed on the hind part.

The length of this species is nearly fourteen inches, the breadth about ten, measuring the curvature of the shell. The head which is flat and triangular above, is nearly two inches long, above an inch broad, and one inch deep. The eyes are furnished with a nictitating membrane; but the lower eyelid only is moveable. The mandibles are strong, notched, and internally beset with protuberances which have been sometimes mistaken for teeth. The external orifices of the ears are covered with the common skin. The tail is very short. The fore legs are about three inches and a half long; the hind legs are about two and a half long. The skin is grainy, and covered with brown coloured, unequal, hard scales, extending over the head, legs, and tail. Some of these scales on the ends of the feet are large, hard, and pointed; so that at first sight they might be taken for claws. The feet are thick, and so covered with the investing membrane, that the toes are only distinguished.

Tortoises.

The disk of the shell is composed of thirteen pieces which are striated on the margin. The border consists of twenty-four pieces; all of which, especially the posterior ones, are proportionally larger than in the other species. From the position of the latter, the circumference of the upper shell appears toothed. The upper shell is very convex, being more than four inches deep: in consequence of this form, when the animal is placed on its back, it can recover its former situation.

The colour of this species is generally dark, or blackish-bay. The convex part of the pieces which compose the disk are irregularly varied with yellow. The pieces are also variegated with the same colour. This prevails chiefly on the posterior divisions, and these are distinctly striated or furrowed. The width or dilatation of these divisions, being greater than in other species, constitutes the principal characteristic mark of the present. The colour of the under shell is pale yellow; each division is marked on its upper joining with a transverse blackish band, which runs into a pair of pointed or triangular processes, extending nearly to the inferior division. Another specific difference between this and the common tortoise is, that in the former the outline of the shell, seen from above, is proportionally longer, and has a slight sinking or contraction on each side.

It is supposed that this species is a native of America, but this seems not to be certainly determined; and little, or scarcely any thing, is known of its natural history.

3. Testudo Geometrica, *Geometrical Tortoise.*

Specif. Char.—The shell is black and ovate; the scutella elevated, and radiated with yellow.

The number of pieces of which the disk is composed, is subject to variation. Instead of thirteen, fourteen pieces have been observed in different specimens. These pieces are very prominent, striated distinctly with numerous lines on their sides, and terminated above by a yellowish coloured, flat, hexagonal roughened space, from which proceed, in a radiated direction, some well defined yellow streaks towards the edge; in this forming on the black ground colour, something like geometrical figures. The marginal pieces are commonly 24, but sometimes 26. They also are streaked with yellow. As in other species, the brightness of the colours is subject to variation, but their regular distribution is never entirely obliterated.

This species, it is said, is a native of Asia, Africa, and also of America; but this seems not to be fully ascertained, which is rather surprising, as its shell is oftener met with in Europe than that of any other species. Thunberg says that it is a native of the Cape of Good Hope, where it frequents shrubby places. It is said also, that it is found on the coast of the Pine islands, between the continent of America and Cuba, where they frequent moist and marshy places in the forests. They are very easily taken, and are sought after as food. It is usual for the natives to put a mark on the shield, and then to allow them to go about in the woods, finding them again almost as readily as any domesticated animal, when they transport them to Cuba. This species

Tortoiſes. cies is ſuppoſed to be the *terrapin* of Dampier, who gives the above account, and repreſents it as beautifully variegated.

4. Testudo Radiata, *Radiated Tortoiſe.*

Specif. Char.—Shell ovate, black; ſcutella flattiſh, and radiated with yellow.

This ſpecies has ſometimes been confounded with the preceding; it often however exceeds a foot in length, and its outline is nearly ſmooth. The ſize of the geometrical tortoiſe is leſs, its outline is very much tuberculated, and the pieces of which it is compoſed riſe greatly towards their centres.

According to Grew, it is a native of Madagaſcar; and its characters correſpond nearly with one deſcribed by Browne in his hiſtory of Jamaica, ſo that it muſt alſo be conſidered as a native of that iſland. Grew has given a very particular deſcription of it.

5. Testudo Indica, *Indian Tortoiſe.*

Specif. Char.—Shell brown, reflected above the neck; the three upper ſcutella are marked with a tubercle.

This is a very large ſpecies, which was firſt deſcribed by Perrault in the hiſtory of animals publiſhed by the Royal Academy of France. It meaſured from the tip of the noſe to the tail four feet and a half; the height or convexity was about fourteen inches; the ſhell itſelf was in length three feet, and two in breadth; the colour was of a dull brown. The pieces compoſing the ſhield were large and diſſimilar, of which the three anterior were marked in the middle with a round knob or tubercle, about half an inch wide. The ſkin of the head, feet, and neck, was wrinkled and granulated; the fore legs were nine inches long, the feet undivided, with five blunt claws: the hind legs were eleven inches long, with four toes, each armed with a claw; the tail ſix inches thick at the baſe, fourteen inches in length, and terminating in a horny bent proceſs. This ſpecies is a native of the coaſt of Coromandel.

Var. 1. A variety of this ſpecies brought from the Cape of Good Hope, is deſcribed by Voſmaer: it was about 2¾ feet long, 1¼ foot broad, one foot high, with thirteen pieces in the diſk, and twenty-five in the margin. In this, the three tubercles on the anterior pieces of the ſhield are wanting.

Var. 2. Another variety of this ſpecies, of a very large ſize, has been brought from the South Sea iſlands. The ſhell, which is of a dull uniform brown, with a ſmooth ſurface, is of an ovate, oblong form, widening at the bottom, and contracting conſiderably on each ſide of the neck. It is at leaſt three feet and a half long; the diviſions are all even, but the whole ſurface of the ſhell is marked with regular elevations and depreſſions.

Testudo Rugosa, *Wrinkled Tortoiſe.*

Specif. Char.—Shell black, wrinkled, mottled and variegated with yellow; the middle dorſal piece ſubpanduriform.

This ſpecies, of which a ſpecimen is preſerved in the Leverian muſeum, is deſcribed by Dr Shaw†. The colour is dark brown, or black, thickly mottled with ſmall confluent ſpots of pale yellow, which are largeſt on the ſides of the ſhell. The form of the ſhell is long and oval, dilated or widened behind; the depth or convexity is very conſiderable. The three middle diviſions of the row of ſcutella on the back are ſomewhat panduriform, or fiddle-ſhaped. The upper piece reſembles the outline of a pitcher; the loweſt approaches to a hexagonal form. The number of the ſide pieces is four, of the uſual form; that of the marginal pieces is twenty-five, the upper one very ſmall. A carina or ridge runs down the dorſal row; the upper ſurface of the ſhell is ſtrongly wrinkled. The under ſhell is ſmooth, and of a yellowiſh white colour, mottled with black. The length of the ſhell is nine and a half inches; width in the middle five inches. Its native country is unknown. Tortoiſes. † *Gen. Zool.* vol. iii. p. 28.

Var. A variety of this ſpecies is alſo deſcribed, conſiſting chiefly in the colours of the ſhell, and owing, it is ſuppoſed, to a ſexual difference.

7. Testudo Europea, *Speckled Tortoiſe.*

Specif. Char.—Shell oval, flattiſh, ſmooth, dark-brown, marked with numerous yellowiſh ſpecks and ſtreaks. *Teſtudo orbicularis*, Lin.

This ſpecies is from four to five inches long; the colour is blackiſh or olive brown; the ſhell flattiſh, but ſlightly convex, marked with numerous, oblong, yellow ſpecks, diſpoſed in a radiated form on each diviſion of the ſhell. The ſkin of the neck and breaſt is ſimilarly ſpotted. The diſk conſiſts of thirteen, and the margin of twenty-five pieces. The under ſhell is of a whitiſh yellow, tinged with brown at the joints. The head is ovate, ſomewhat convex above, flattiſh on the ſides and beneath. The ſkin of the neck is wrinkled and looſe. The legs are ſhort, and covered with ſcales. The feet are webbed, the fore feet having five toes, the hind only four. The claws are ſharp pointed and crooked; the tail is nearly half the length of the body, and is thin and compreſſed.

This ſpecies is a native of Italy, Sardinia, France, Hungary, and Pruſſia, as well as other parts of Europe. It inhabits lakes and muddy waters, feeding on ſmall fiſh, inſects, ſnails, and aquatic plants. The fleſh is eſteemed and employed as food, and in ſome places brought to market for ſale. It is ſometimes kept in ponds for the purpoſe, and fed with lettuce leaves, bread, &c. It may be kept in a cellar, and fed with oats ſcattered on the floor, which it eats as ſoon as they begin to germinate. In the beginning of ſpring it depoſits its eggs in ſandy places, expoſed to the ſun; and it has been ſaid, that theſe are not hatched till the ſpring following. The growth of this animal is extremely ſlow, and it varies ſomewhat in colour, according to the climate where it is found.

8. Testudo Lutaria, *Mud Tortoiſe.*

Specif. Char.—The ſhell is flattiſh, and the tail is half the length of the body.

The length of this ſpecies does not exceed ſeven or eight inches from the tip of the noſe to the end of the tail. The breadth is about three or four inches. The diſk is compoſed of 13 pieces, which are ſtriated and ſlight-

Tortoiſes. ly punctated in the centre. A longitudinal ridge runs along the middle range. The margin conſiſts of 23 pieces ſlightly ſtriated on the edges. The ſhell is blackiſh, as well as the ſkin; the feet are webbed, and have five toes before and four behind.

This ſpecies is a native of many parts of Europe; it is alſo found in different parts of Aſia, as in India and Japan. It is very common in France, particularly in Languedoc, and in different parts of Provence. It is ſaid that ſuch numbers were found one time in a lake half a league wide, in the plain of Durance, that the neighbouring peaſantry were ſupported by them for more than three months.

This ſpecies always lays its eggs on land, digging a hollow in the ground, and covering the eggs with earth. When the young are firſt hatched, they are only about half an inch in diameter. The motions of this ſpecies are quicker than thoſe of the land tortoiſe. It continues to grow for a long time, and lives for upwards of 24 years. It has been found uſeful in gardens, by deſtroying ſmall ſnails, and other animals which are deſtructive to vegetables; but it ought to be obſerved, that it is diſpoſed to attack and deſtroy the fiſh in fiſh-ponds.

9. Testudo Carinata, *Carinated Tortoiſe.*

Specif. Char.—Feet digitated; ſhell gibboſe; four firſt dorſal ſcutella carinated; ſternum entire.

The ſhell of this ſpecies does not exceed three inches in length. The form is broad, and ſomewhat orbicular; the colour is brown, and each ſcutellum is marked with a pale zone of confluent ſpots, which ſurround the centre part, the edges of each being ſurrounded with three or four diſtinctly marked furrows. Marginal pieces 25 in number, including the uppermoſt, which is very ſmall. Its native country is unknown.

10. Testudo Carolina Lin. Testudo Clausa Shaw. *Cloſe Tortoiſe.*

Specif. Char.—Shell blackiſh, irregularly ſpotted with yellow; dorſal carina obtuſe; under ſhell bivalve, completely incloſing the upper ſhell.

This ſpecies is thus deſcribed by Edwards. "The head is furniſhed with a hard or ſhelly covering of a dark brown colour on the top: on the ſides and throat it is yellow, with ſmall black or duſky ſpots: its noſtrils are near together, a little above the end of the beak: the eyes are of a yellowiſh colour: the neck is covered with a looſe ſkin of a dark purpliſh fleſh colour, which partly covers the head when it is not fully extended: the hinder legs and parts about the vent are covered with a ſkin of the ſame dull fleſh colour as the neck: the fore-legs and feet are covered with yellow hard ſcales: it hath five toes on each foot forwards, and four on each of the hinder feet, all armed with pretty ſtrong claws: the ſhell above riſes pretty much, and is round, divided into ſeparate ſcales of the horny ſubſtance called tortoiſe ſhell: each ſcale is engraven, as it were, with rings round its extremities, which leſſen inwards to its centre: the ſhell above is of a duſky brown colour, with yellowiſh ſpots of various forms: underneath it is flattiſh, and of a yellow colour, with black clouds and ſpots: it has only the rudiment of a tail, on which the vent is placed: the lower ſhell is divided acroſs the middle of the belly, and joined to the upper ſhell by a tough though flexible ſkin, by which means it can, when it draws in its head and legs, cloſe up its ſhell as firmly as an oyſter." From this peculiarity in its ſtructure, this ſpecies has derived its name; and this proves ſo ſtrong a defence to the little animal, that it ſeems not only not to receive any injury, from having a weight of five or ſix hundred pounds laid upon it, but to walk under the load without any inconvenience. Tortoiſes.

The length of this ſpecies ſeldom exceeds four or five inches. It is a native of North America, and is chiefly found in marſhy ſituations; but it alſo ſometimes appears in dry and warm places. It lives both on vegetables and animals. Of the latter beetles, mice, and ſometimes ſerpents, are its prey. Theſe it ſeizes, draws them into its ſhell, and cruſhes them to death. It is much in requeſt on account of its eggs, which are eſteemed a great delicacy. They are about the ſize of a pigeon's egg.

11. Testudo Sulcata, *Sulcated Tortoiſe.*

Specif. Char.—Shell brown, ovate; ſcutella furrowed, and yellow on each ſide.

This ſpecies exceeds a foot in length, from the tip of the noſe to the end of the tail; ſo that it is one of the larger of the land tortoiſes. The ſhell is very convex. The diſk is compoſed of 13 pieces, which are five and ſix-ſided; and each is tranſverſely and ſtrongly furrowed from the lower edge to the upper area; acroſs theſe run three impreſſed lines in an oppoſite direction: the marginal pieces are furrowed in the ſame manner. The colour of the ſhell is in general a dull yellow; but both the ſhield and marginal pieces have a brown and yellow diviſion. The head is large and covered with ſix-ſided ſcales of different ſizes. The fore and hind legs are alſo ſcaly; on the former are five claws, on the latter only four. The tail is very ſhort.

This ſpecies is a native of the Weſt Indies; and it is ſuppoſed to be the ſame with the *hicatee* deſcribed by Browne in his Hiſtory of Jamaica.

12. Testudo Tabulata, *Tabular Tortoiſe.*

Specif. Char.—Shell brown, oblong, gibbous; ſcutella of the diſc rectangular and furrowed, having yelloviſh coloured centres.

The ſhape and ſize of the pieces of which the diſc is compoſed, are more uniform than in any other belonging to this genus. This ſeems to be the principal mark of diſcrimination. Each piece is ſlightly convex, and in general ſix-ſided, excepting ſome of the pieces towards the ſides, which are five-ſided. The central part of each piece is large, and ſlightly granulated, and the ſides are diſtinctly ſulcated. The whole has a kind of flattened or tabular appearance: the colour is a yelloviſh cheſnut; it is paler on the centre of each diviſion; the legs are thick, and ſpotted with red; the number of pieces on the diſc is 13, that of the margin 23. The length of the ſhell is from five to ſix inches. It is ſuppoſed to be a native of Africa but according to ſome, it has been found in Brazil.

13.

Tortoiſes.

13. Testudo Concentrica; *Teſtudo Paluſtris* Lin. *Concentric Tortoiſe.*

Specif. Char.—Shell ſomewhat depreſſed, ſlightly ridged, oval, of a yellow colour; having the ſcutella marked with brown concentric zones.

The ſhell of this ſpecies is flatter than that of others; in ſome of the larger ſpecimens nearly ſmooth: the middle row of pieces, of which the diſc is compoſed, are five in number; they are more elevated than thoſe of the ſides, are ſix-ſided, and project behind into an obtuſe carina. There are four ſide-pieces on each ſide, which are pentagonal. The ground colour of the whole is pale, and marked with brown zones and centres. The ſhell is from four to ſix inches long.

This tortoiſe is a native of North America, and is met with in the markets at Philadelphia, where it is ſold under the name of *terrapin*. It is alſo a native of Jamaica, where it is very common. It is ſaid, by Brown, who ſeems firſt to have deſcribed it, to be a wholeſome and delicate food. In that iſland, it grows to the length of eight or nine inches.

14. Testudo Picta, *Painted Tortoiſe.*

Specif. Char.—The ſhell is oblong, and ſlightly convex, ſmooth, and of a brown colour; the ſcutella are bordered with yellow.

This ſpecies is well diſtinguiſhed from all others, by the remarkable colours of the ſhield, which conſiſts of 13 ſegments nearly ſquare, and deeply edged with pale yellow. The marginal pieces are 25 in number. The ſhell is from four to ſix inches long.

The painted tortoiſe frequents freſh waters, and in particular, is found in the ſlow and deep rivers of North America. In bright ſunſhine weather they leave the water in great numbers, and baſk themſelves on ſtones, pieces of wood, and the banks of the ſtreams, ſuddenly retreating into the water, when they are diſturbed. They walk very ſlowly, but ſwim with great rapidity. They can remain for many hours together under the water, but live only a few days in the open air. They are extremely voracious, and are known to deſtroy young aquatic fowls, ſeizing them by the feet, and dragging them under water. Sometimes they are employed for the purpoſe of food.

15. Testudo Guttata, *Spotted Tortoiſe.*

Specif. Char.—Shell oblong, ſlightly convex, ſmooth, and of a brown colour, with ſcattered yellow ſpots.

This ſpecies is alſo ſufficiently diſtinguiſhed by its remarkable colour. The pieces both of the diſc and margin being marked with a few diſtantly placed round yellow ſpots. Theſe ſpots vary, as well as the ground, in different individuals. The young of this ſpecies, which itſelf is ſmall, are not larger than a pigeon's egg, are very black, and beautifully ſpotted with gold colour.

This tortoiſe is a native of North America, frequenting lakes and rivers.

16. Testudo Elegans, *Elegant Tortoiſe.*

Specif. Char.—The ſhell is round, convex, and of a yellow colour, with tranſverſe, oval, brown ſpots.

This is a very ſmall ſpecies, only about two inches long; the ſhell is of a bright yellow colour, the ſurface apparently ſmooth. At each of the joinings which compoſe the diſc, there is a large, leaf-ſhaped, dark brown tranſverſe ſpot. The marginal pieces are marked with a tranſverſe black zone; the head is ſhort and thick. Tortoiſes.

Nothing particular is known of its natural hiſtory, or to what country it belongs.

17. Testudo Areolata, *Areolated Tortoiſe.*

Specif. Char.—The ſhell is ſlightly convex; the ſcutella are nearly four-ſided, elevated, deeply furrowed, and are furniſhed with depreſſed rough areolæ.

The length of this ſpecies is from three to four inches. The ſcutella, which are nearly four-ſided, are broader than long, with a pretty large, depreſſed, central part, which is of a yellow colour, roughiſh, and ſurrounded by a pale zone. The margin is compoſed of 25 pieces; the diſc, in ſome individuals, of 15, and in others of 14.

This tortoiſe, according to ſome, is a native of Brazil, according to others, of the Eaſt Indies.

18. Testudo Serrata, *Serrated Tortoiſe. Teſtudo Spengleri*, Lin.

Specif. Char.—Shell depreſſed, of a yellow colour, and minutely freckled with duſky ſpecks. The ſcutella of the diſk are all ridged; the hinder margin of the ſhell ſerrated.

This tortoiſe is conſidered and deſcribed by Dr Shaw as a new ſpecies; it is ſmall, only about three quarters of an inch long, and about two inches and a half broad. It is of an oval form, and ſlightly convex. The colour is of a yellowiſh brown, and when cloſely examined, appears thickly marked with minute, confluent, duſky ſpots. The under ſhell is blackiſh, with a yellow margin.

The native country of this ſpecies is unknown.

19. Testudo Pusilla, *Little Tortoiſe. African Land Tortoiſe* of Edwards.

Specif. Char.—Shell hemiſpherical, with convex, trapezoidal ſcutella, ſtriated on the margin, and dotted on the diſc. Feet ſubdigitated.

The ſhell of this ſpecies meaſures only about four inches in length. The whole animal, from the tip of the noſe to the end of the tail, does not exceed ſix. This ſpecies has a conſiderable reſemblance to the common tortoiſe, or *teſtudo græca*. It is particularly deſcribed by Edwards, who kept two of them which he received from Weſt Barbary for two years in the garden of the college of phyſicians in London; but of its natural hiſtory, nothing farther is known.

20. Testudo Tricarinata, *Tricarinated Tortoiſe.*

Specif. Char.—Shell oval, ſlightly convex; margin entire; all the ſcutella of the diſc carinated.

This ſpecies reſembles a good deal the *teſtudo orbicularis*, Lin. In ſize it ſcarcely exceeds that of a large walnut; the colour is blackiſh; the ſhell is compoſed

Tortoiſes. of 13 ſcutella; the number of the marginal pieces is 23. Each ſcutella is marked in the middle with a longitudinal ridge, and wrinkled on the ſides with ſeveral furrows and roughiſh points.

Its native place, and its natural hiſtory, are unknown.

21. Testudo Scabra, *Rough Tortoiſe.*

Specif. Char.—Shell flattiſh, the intermediate ſcutella elevated on the back; feet palmated.

This tortoiſe is about two inches and a half in length, and nearly two in breadth. Its form is ſomewhat cordated, of a light reddiſh colour, finely variegated on the head and ſhell, with waved white lines and ſpots. The feet, each of which is furniſhed with five toes, with ſharp claws, are marked with red ſpots. The head is prominent, and the eyes are ſmall.

It is conſidered by ſome naturaliſts as a native of Amboyna.

22. Testudo Scripta, *Letter'd Tortoiſe. Teſtudo Scabra* of Thunberg.

Specif. Char.—Shell depreſſed, orbicular; ſcutella marked with various figured characters; marginal pieces ſpotted underneath.

This ſpecies is either very ſmall, or the ſpecimen from which the deſcriptions have been taken were very young, as it did not exceed the ſize of a half-crown piece. It is flattiſh, of a round form, and whitiſh colour tinged with yellow. The upper ſurface is marked with various figures, having ſomewhat the appearance of written characters. The pieces of the margin, which are 25 in number, are marked with ſimilar characters as thoſe of the ſcutella. The feet are large, webbed, and have five toes furniſhed with ſharp claws.

It is not mentioned to what country it belongs.

23. Testudo Galeata, *Galeated Tortoiſe.*

Specif. Char.—Shell depreſſed, oval; the three middle ſcutella ſharply ridged; marginal pieces 24.

This is a ſmall ſpecies, not exceeding two inches and a half long, and about two broad. The colour of the ſhell is pale brown, and the diſc is compoſed of 13 ſcutella, of which the middle row is very broad, and ſtrongly ridged in the middle. Marginal pieces 24 in number, and ſimilar in colour to the diſc, but having white edges. The head is ſmooth, furniſhed with a kind of ſhield, from whence it derives its ſpecific name.

Its native place is unknown; but an individual of this ſpecies, brought from India, lived two years. It was kept in freſh water, and could occaſionally remain for a few hours in the open air. Its food was bread and flies. It continued in a kind of dormant ſtate during the winter, taking no food from the beginning of October till the middle of May, and ſcarcely ever raiſing its head above the ſurface of the water.

24. Testudo Denticulata, *Denticulated Tortoiſe.*

Specif. Char.—Shell roundiſh, and heart-ſhaped; marginal ſegments denticulated; feet ſubdigitated.

This ſpecies is about four inches long and three broad. Tortoiſes. The ſhell is of a pale yellowiſh brown colour; the diſc is compoſed of broad five and ſix ſided ſcutella. They are flattiſh, and have a large diſtinct ſpace in the middle, granulated with ſmall tubercles. The other part of the ſcutellum is marked with five furrows; the marginal pieces are 23 in number, and project in a ſerrated form.

It is ſuppoſed to be a native of North America.

25. Testudo Pennsylvanica, *Pennſylvanian Tortoiſe. Small Mud Tortoiſe* of Edwards.

Specif. Char.—Shell brown, ſmooth, elliptic; back flattiſh; the middle row of ſcutella ſomewhat rhomboidal and imbricated. The firſt is ſubtriangular.

This is a ſmall tortoiſe; the length of the ſhell, at its full growth, does not exceed three or four inches. In this ſpecies, the middle row of dorſal pieces are longer than in others, and are ſo arranged as to overlap each other at the tips. The marginal pieces are 23 in number, the upper one being very ſmall. The edges of the ſhell are tinged with dull yellow. In the joinings of the pieces, this ſpecies reſembles the ſtructure of the cloſe tortoiſe, ſo that the animal has the power of concealing itſelf almoſt entirely, by cloſing up its ſhell.

It is a native of North America, and is particularly found in Pennſylvania, where it frequents muddy waters, and hence its trivial name of mud tortoiſe. When alive, it is ſaid that it gives out a ſtrong muſk ſmell.

Several varieties of this ſpecies have been noticed by naturaliſts.

26. Testudo Longicollis, *Long-necked Tortoiſe.*

Specif. Char.—Smooth, ovate; neck very long.

This ſpecies is about five inches and a half long, and four and a half broad. The ſhell is of an oval form, of a dark olive brown colour, reſembling in ſome parts of it the grain of common black leather. The diſc is compoſed of 13, and the margin of 25 pieces. The under ſhell is of a yellowiſh colour, marked with black brown at the joinings. The claws on the feet, which are four in number, are like thoſe of birds.

It is a native of New Holland.

27. Testudo Caspica, *Caſpian Tortoiſe.*

Specif. Char.—Shell orbicular, head ſcaly, tail naked; five claws on the fore feet, four on the hind.

This ſpecies of tortoiſe grows to ſuch a ſize, that ſeveral men can ſtand together on its ſhell. The pieces of which the diſc is compoſed are nearly four-ſided, and ſquare: thoſe of the margin are in the form of a parallelogram. The colour is variegated with black and green; the under ſhell is blackiſh, ſpotted with white.

It is a native of Hyrcania, and frequents freſh waters.

28. Testudo Ferox, *Fierce Tortoiſe.*

Specif. Char.—Shell ovate, cartilaginous; three claws on the feet, which are tubular; noſtrils prominent.

This

Tortoiſes. This ſpecies is about one foot and a half in length, and about 15 inches in breadth. The ſhield, which is hard or oſſeous in the middle only, while the edges become gradually flexible and coriaceous, is a ſufficiently characteriſtic mark of diſtinction. The head is ſmall, and ſomewhat trigonal, with the ſnout much elongated. The colour of this ſpecies is browniſh; olive above; and on the under parts white.

This ſpecies is a native of Pennſylvania, Carolina, and other parts of America. It is extremely vigorous and ſwift in its motions, and when it is diſturbed or attacked, it ſprings forward towards its enemy with great fierceneſs. Some which have been found in the rivers and lakes of Eaſt Florida, weighed from 30 to 40 lbs.; and it is ſaid that they even grow to ſuch a ſize as to weigh 70 lbs.

A ſpecies deſcribed by Thunberg, under the name of *teſtudo roſtrata*, is ſuppoſed by Dr Shaw to be an individual belonging to the above, not yet arrived at its full growth. The *teſtudo triunguis* of Forſkal ſeems alſo to be a variety of this ſpecies.

29. Testudo Granulata, *Shagreened Tortoiſe.*

Specif. Char.—Shell granulated, orbicular, flattiſh; border cartilaginous.

The ſhield of this ſpecies meaſures about $3\frac{1}{2}$ inches in length, and $3\frac{1}{4}$ in breadth. It appears as if it were compoſed of two ſhields, the upper of which is the ſmalleſt and ſhorteſt. This is of a bony ſubſtance, roughened all over like the ſurface of ſhagreen. It is compoſed of 23 pieces, eight of which are placed on each ſide. The borders of this ſhield are cartilaginous and ſomewhat tranſparent, through which may be ſeen the ribs of the animal.

This ſpecies is ſaid to be a native of India; but of its habits and natural hiſtory nothing is known.

30. Testudo Fimbriata, *Fimbriated Tortoiſe.*

Specif. Char.—Shell oval, a little convex, and having a triple ridge; neck fimbriated on each ſide; ſnout cylindrical, and feet ſubdigitated.

The length of the ſhell of this ſpecies is above 15 inches, and the breadth 11. The length of the animal, from the tip of the noſe to the end of the tail, is two feet three inches. The head is large and flat, edged on the ſides with wrinkled membranaceous appendages, and covered behind with a three-lobed prominence. The noſe is cylindrical, and ſomewhat reſembles a proboſcis. It is 10 lines long, truncated, and pierced at the tip by the noſtrils. The diſk of the ſhell is a little convex, and compoſed of 13 ſemicircular pieces, which are nearly conical. They are all wrinkled, and irregularly notched at the hinder part. The marginal pieces are 25 in number, nearly ſquare, radiated on the ſurface with oblique wrinkles, and toothed on the inner edge. The colour is brown, and ſomewhat paler beneath.

This ſpecies is ſaid to be a native of Guiana, and was once common in the rivers of Cayenne; but it is now rarely to be met with, having been much ſought after as a nouriſhing food. Its food is aquatic plants; and it is ſaid that it leaves the river, and wanders about in the night, to ſome diſtance from the banks, in ſearch of paſture. The individual from which the deſcription is taken by M. Bruguierre, was brought to him alive, and lived for ſome time on herbs, bread, and ſome other ſubſtances. It laid ſeveral eggs, one of which produced a young tortoiſe in the box where it was kept. Turtles.

31. Testudo Serpentina, *Snake Tortoiſe.*

Specif. Char.—Shell ovate, depreſſed, triply carinated, and ſharp ſcaled; rounded and acutely ſerrated at the poſterior margin.

This ſpecies grows to the weight of 15 or 20 lbs. The general colour is of a dull cheſnut brown, but lighter or paler underneath. The head is large, triangular, and covered with a warty ſkin. The neck is alſo covered with ſcaly warts. The toes, which are five in number on the fore feet, and four on the hind feet, are all diſtinct, but connected by means of a web. They are armed with long claws. The tail is ſtraight, two-thirds the length of the ſhell, compreſſed, and creſted on the upper part with ſharp bony ſcales, pointed backwards.

This ſpecies is a native of North America; inhabiting ſtagnant waters, where it preys on fiſh, ducklings, &c. ſeizing its prey with great force. And indeed, whatever it ſeizes with its mouth, it holds with ſuch force, that it will ſuffer itſelf to be raiſed out of the water rather than quit its hold. The more eaſily to catch its prey, it is ſaid too, that it conceals itſelf in muddy waters, leaving out only part of its back, which has the appearance of a ſtone.

32. Testudo Squamata, *Scaly Tortoiſe.*

Specif. Char.—Body ovate, ſmooth beneath; but the upper part with the neck, feet, and tail, covered with numerous ſcales.

The head of this ſpecies is ſmall, reſembling that of a ſnake; the eyes are ſmall and moveable, the teeth ſharp. All the upper part of the body is covered with ſcales; the under parts are ſoft, ſmooth, and tender; the tail is pretty long.

It is ſaid to be a native of China and Java. The fleſh is accounted a great delicacy, and the ſcales, pulveriſed and diſſolved in water, are given by the Chineſe as a remedy in caſes of dyſentery and colic.

Sect. II. *Turtles, or Sea Tortoiſes.*

The large and long fin-ſhaped feet, which incloſe the bones of the toes, are the moſt obvious characteriſtic marks of diſtinction between the ſea tortoiſes, and the ſpecies included under the preceding ſection. In the ſea tortoiſes the ſhield is alſo compoſed of a ſtrong bony covering, which is coated externally with hard horny plates, which in ſome of the ſpecies are much thicker and ſtronger than thoſe of the land tortoiſes.

33. Testudo Coriacea, *Coriaceous Turtle.*

Specif. Char.—Colour brown, paler beneath; ſhell coriaceous, marked with five longitudinal, tuberculated ribs.

This ſpecies, in the form of its body, which is proportionally longer, and in its outer covering, which is not-

Turtles. not of a horny ſubſtance, but reſembles ſtrong leather, is ſufficiently diſtinguiſhed from others. Five diſtinct, prominent, tuberculated ridges run along the whole length of this covering. This ſpecies is not furniſhed with an under or thoracic ſhell. The head is large, and the upper mandible is notched at the tip, which gives it the appearance of having two large teeth. The fins are large and long, and covered with a tough leathery ſkin. The general colour is duſky brown, but paler beneath.

The coriaceous turtle is a native of the European ſeas. It is alſo found on the coaſts of South America and Africa. It frequents the Mediterranean ſea, and has been occaſionally met with on the coaſts of France and England. This ſpecies, of all the turtles, grows to the largeſt ſize. Some have been taken eight feet in length, and weighing no leſs than 1000 lbs. One was taken in the month of Auguſt 1729, not far from the mouth of the Loire in France, which meaſured ſeven feet one inch in length, three feet ſeven inches in breadth, and two in thickneſs. It is reported that it uttered ſo hideous a noiſe when it was taken, that it might be heard at the diſtance of a quarter of a league. At the ſame time it foamed at the mouth, ſeemingly with rage, from which it emitted a noiſome vapour. Another was taken in 1778, on the coaſt of Languedoc, which meaſured ſeven feet five inches in length. One taken on the coaſt of Cornwall in July 1756, meaſured, from the tip of the noſe to the end of the ſhell, ſix feet nine inches, and the weight was ſuppoſed to be near 800 lbs.

The Greeks, it is ſuppoſed, were acquainted with this ſpecies of turtle, which they employed in the conſtruction of the ancient lyre or harp. The fleſh of this ſpecies is extremely fat, but coarſe and ill-flavoured; but the religious order of Carthuſians prefer it to that of every other.

34. Testudo Mydas, *Green Turtle.*

Specif. Char.—Of a browniſh colour, with 13 ſcales on the diſc.

This is the eſculent, or common green turtle; the latter name being derived from the colour of the fat. This is ſuppoſed to be owing to the vegetable matters on which the animal feeds, and eſpecially the *zoſtera marina*, or turtle graſs, of which it is ſaid to be extremely fond. This ſpecies is one of the largeſt of the genus, often exceeding five feet in length, and weighing 500 or 600 lbs. The ſhell is ſomewhat heart-ſhaped, pointed at the extremity, and compoſed of 13 dorſal diviſions, with 25 marginal pieces. The colour is of a dull pale brown, more or leſs variegated with deeper undulations, but leſs ſtrong and beautiful colours, than the hawkſbill turtle, which yields the tortoiſe ſhell.

The green turtle is a native of all the ſeas within the torrid zone.

This ſpecies of turtle has been long eſteemed a delicious food by the inhabitants of many of the iſlands and continents within the torrid zone. In the time of Sir Hans Sloane, the inhabitants of Port Royal in Jamaica employed 40 ſloops for the purpoſe of catching them. The markets were at that time, as they are at preſent, ſupplied with turtle in the ſame way as thoſe of Europe are with butcher's meat. Many of them, according to Cateſby, are carried from the Bahama iſlands to Carolina, where they are eſteemed as a great delicacy. "They feed," he adds, on a kind of graſs, growing at the bottom of the ſea, commonly called *turtle graſs*. The inhabitants of the Bahama iſlands, by frequent practice, are very expert at catching turtles, eſpecially the green turtle. In April they go in boats to Cuba, and other little neighbouring iſlands, where, in the evening, eſpecially on moon-light nights, they watch the going and returning of the turtle, to and from their neſts, at which time they turn them on their backs, where they leave them, and proceed on, turning all they meet, for they cannot get on their feet again when once turned. Some are ſo large, that it requires three men to turn one of them (A). The way by which the turtle is moſt commonly taken at the Bahama iſlands, is by ſtriking them with a ſmall iron peg of two inches long, put in a ſocket at the end of a ſtaff of 12 feet long. Two men uſually ſet out for this work in a little light boat or canoe, one to row and gently ſteer the boat, while the other ſtands at the head of it with his ſtriker. The turtle are ſometimes diſcovered by their ſwimming with their head and back out of the water; but they are oftenеſt found lying at the bottom, a fathom or more deep. If a turtle perceive he is diſcovered, he ſtarts up to make his eſcape; the men in the boat purſuing him, endeavour to keep ſight of him, which they often loſe, and recover again, by the turtle putting his noſe out of the water to breathe. Thus they purſue him, one paddling or rowing, while the other ſtands ready with his ſtriker. It is ſometimes half an hour before he is tired; then he ſinks at once to the bottom, which gives them an opportunity of ſtriking him, which is by piercing him with an iron peg, ſlipping out of the ſocket, but is faſtened with a ſtring to the pole. If he is ſpent and tired by being long purſued, he tamely ſubmits when ſtruck, to be taken into the boat, or hauled athore. There are men who, by diving, will get on their backs, and by preſſing down their hind parts, and raiſing the fore part of them by force, bring them to the top of the water, while another ſlips a nooſe about their necks".

Turtles. Mode of taking the turtle.

"The turtle never go on ſhore, except to lay their eggs, which is in the month of April. They then crawl up from the ſea above high-water mark, where they dig a hole two feet deep in the ſand, into which in a ſingle night they drop above 100 eggs. At this time they are ſo little liable to be diſturbed, that they have been known to drop their eggs into a hat held by a perſon under them. If, however, they happen to be diſturbed before they begin to lay, they forſake the place, and ſeek another. They lay their eggs at three, and ſometimes at four different times, a period of fourteen days elapſing between each time. When they have laid their complement of eggs, they fill the hole with

Eggs hatched by the ſun.

(A) We have ſeen the ſame mode of watching and turning the turtle practiſed in Jamaica, and the phraſe there is not to take or ſeize the turtle, but to *turn* it.

Turtles.

with ſand, and leave them to be hatched by the heat of the ſun. This is uſually accompliſhed in about three weeks". The eggs are round, white, covered with a ſmooth parchment-like ſkin, and about the ſize of tennis balls.

Although the green turtle be a native of the ſeas within the torrid zone, it is ſometimes found on the coaſts of Europe, where it has probably been driven by ſtorms, or has fallen overboard from ſhips from the Weſt Indies. A turtle of this kind, of the enormous ſize of ſix feet long, by four broad, and of the weight of 800 or 900 pounds, was taken at Dieppe in France in 1752; and two years afterwards, another ſtill larger was taken on the ſame coaſt.

Introduced into Europe.

The fleſh of the green turtle is not only highly eſteemed in thoſe countries of which it is a native, but alſo ſo much ſought after in Europe, that the importation of it now forms a conſiderable article of trade, few ſhips returning from the Weſt Indies without bringing ſome turtle. But the turtle which now forms a diſh, by no means uncommon at the tables of the luxurious, ſeems to have been little known in Britain previous to the middle of the 18th century; and indeed it was ſo rare an occurrence, that when one was eaten, it was announced to the public as a piece of news. This appears from the following articles of intelligence. "Friday, Auguſt 31. a turtle weighing 350 pounds was eaten at the King's Arms tavern, Pallmall; the mouth of an oven was taken down to admit the part to be baked." Gent. Mag. for 1753. "Saturday, September 29. the Turtler, Capt. Crayton, lately arrived from the iſland of Aſcenſion, has brought in ſeveral turtles of above 300 pounds weight, which have been ſold at a very high price. It may be noted, that what is common in the Weſt Indies, is luxury here." Ibid. 1753. "Saturday, July 13th, the Right honourable Lord Anſon made a preſent to the gentlemen of White's chocolate houſe, of a turtle which weighed 300 pounds weight, and which laid five eggs ſince it was in their poſſeſſion. Its ſhell was four feet three inches long, and about three feet wide. When its head was cut off, at leaſt five gallons of blood iſſued from it, and ſo full was it of life, that the mouth opened and ſhut for an hour after it was cut off." *Ibid.* 1754.

35. Testudo Caretta, *Loggerhead Turtle.*

Specif. Char.—Variegated with 15 dorſal ſcales, of which thoſe of the middle row are gibbous toward the tip.

This ſpecies moſt reſembles in general appearance the laſt ſpecies, or green turtle. The larger ſize of the head, the proportional breadth of the ſhell, the deeper and more variegated colours, are marks of diſtinction ſufficiently characteriſtic; but the number of dorſal ſegments amounting to 15, affords the principal character; for not only the middle row, but thoſe of the ſides contain five pieces; and this number is almoſt always uniform and conſtant. There is a conſiderable protuberance on each of the pieces of the middle row, which conſtitutes a range of tubercles along the back of the ſhield; the fore feet are very large and long; the hind feet are broad, but much ſhorter.

This ſpecies frequents the ſame ſeas with the green turtle, but it is alſo found occaſionally in very diſtant latitudes, as in the Mediterranean, and particularly about the coaſts of Italy and Sicily. Turtles.

Excepting the coriaceous turtle, this ſpecies is the largeſt in ſize which has yet been diſcovered. In the Leverian muſeum, there is a ſkull which ſeems to belong to this ſpecies. It meaſures above a foot in length, and it is ſaid that it was taken from a turtle, the weight of which exceeded 1600 pounds.

In a commercial point of view the loggerhead turtle is of little importance; for the fleſh is coarſe and rank, and the plates of the ſhell are too thin to be applied to the uſual purpoſes of tortoiſe ſhell. It yields, however, a conſiderable quantity of oil, which is fit for burning in lamps.

Great ſtrength of this ſpecies.

This ſpecies is very ſtrong and fierce; it can defend itſelf very vigorouſly with its legs, and with its mouth it is able to break the ſtrongeſt ſhells and other ſubſtances. One which was exhibited at Bologna, in an inſtant bit in two a thick walking ſtick which was offered to it.

and fierceneſs.

The following is the account of this ſpecies of turtle which is given by Cateſby. "The loggerhead turtles, ſays he, are the boldeſt and moſt voracious of all others: their fleſh is rank, and therefore little ſought for, which occaſions them to be more numerous than any other kind. They range the ocean over; an inſtance of which, among many others that I have known, happened in April 1725, in N. Lat. 30°. when our boat was hoiſted out, and a loggerhead turtle ſtruck as it was ſleeping on the ſurface of the water. This, by our reckoning, appeared to be the mid way between the Azores and the Bahama iſlands, either of which places being the neareſt land it could come from, or that they are known to frequent, there being none on the north continent of America farther north than Florida. It being amphibious, and yet at ſo great a diſtance from land in the breeding time, makes it the more remarkable. They feed moſtly on ſhell fiſh, the great ſtrength of their beaks enabling them to break very large ſhells, as the large *buccinum* and *trochi*."

36. Testudo Imbricata; *Imbricated* or *Hawkſbill Turtle.*

Specif. Char.—Variegated, and having thirteen imbricated ſcales on the diſk.

In this ſpecies the outline of the ſhell exhibits more of a cordated form than any other; and the termination of the ſhell is more acute. Each of the middle row of ſcales on the back is alſo of a ſharpened form at the tip, and a ridge runs down the middle. The head is proportionally ſmaller than in other turtles; and the neck is longer, narrower, and more curved, thus reſembling the bill of a hawk; hence deriving its trivial name. The ſpecific name of imbricated is taken from the peculiarity in the diſpoſition of its ſcales, which overlap each other at the extremities like the tiles on the roof of a houſe.

The length of this ſpecies is about three feet from the tip of the bill to the end of the ſhell; but ſome individuals have been found which meaſured five feet in length, and weighed from five to ſix hundred pounds; and it is ſaid that ſome have been met with in the Indian ocean, of enormous magnitude.

The hawkſbill turtle is a native both of the Ame-

rican

Turtles. rican and Aſiatic ſeas; ſometimes, but more rarely, it is met with in the Mediterranean.

The ancients employed the ſhell of this ſpecies of turtle for the purpoſe of a ſhield; and even at the preſent day it is uſed for a ſimilar purpoſe among rude nations. The fleſh of the animal is not held in any eſtimation as a food; but the plates of the ſhell being thicker, ſtronger, and clearer, than thoſe of any other ſpecies, render it of great importance as an article of trade. Theſe plates conſtitute the ſubſtance which is well known under the name of *tortoiſe ſhell*. Being ſemitranſparent and finely variegated with many beautiful colours, they afford, after proper preparation and poliſhing, numerous elegant ornaments.

Tortoiſe ſhell.

Mode of obtaining

To obtain the tortoiſe ſhell, the external coating is ſeparated from the bony part by means of heat. A fire is placed under the ſhell, the effect of which is to make the plates ſtart, and then they are eaſily detached from the bone: the thickneſs of the plates varies according to the age and ſize of the animal. They meaſure from one-eighth to a quarter of an inch in thickneſs. Eight pounds of tortoiſe ſhell, it is ſaid, may be obtained from a large turtle. Some even yield, according to other accounts, fifteen or twenty pounds; but unleſs the weight of the animal itſelf be equal to 150 pounds, the ſhell is worth little.

and preparing it.

It may, perhaps, not be unintereſting to our readers, to mention the method which is employed by the artiſt, to give to tortoiſe ſhell the particular forms which are wanted for the different purpoſes to which it is applied. The firſt part of the proceſs is to ſoften it ſufficiently. This is done by ſteeping it in boiling water, after which it is introduced into a ſtrong metallic mould of the form wanted, and to this great preſſure is applied. When a conſiderable extent of ſurface is required, different pieces muſt be joined together. This is done by ſcraping the edges of the pieces to be united, thin, and laying them over each other, while they are in the heated and ſoftened ſtate. Srong preſſure being then applied, they become completely agglutinated. It is in this way that gold, ſilver, and other metals, for different ornaments, are made to adhere to tortoiſe ſhell.

This ſubſtance was greatly ſought after by the Greeks and Romans for ornamental purpoſes. It was not unuſual, among the latter people, to ſee their beds, the doors, and pillars of their houſes, decorated with tortoiſe ſhell; and eſpecially in the reign of Auguſtus, when this kind of luxury reached its greateſt height.

"The Egyptians, according to Mr Bruce, dealt very largely with the Romans in this elegant article of commerce. Pliny tells us, that cutting them for veneering or inlaying, was firſt practiſed by Carvilius Pollio, through which we ſhould preſume that the Romans were ignorant of the art of ſeparating the laminæ by a fire placed in the inſide of the ſhell when the meat is taken out; for theſe ſcales, though they appear perfectly diſtinct and ſeparate, do yet adhere, and oftener break than ſplit, where the mark of ſeparation may be ſeen diſtinctly. Martial ſays that beds were inlaid with it. Juvenal, and Apuleius in his tenth book, mentions, that the Indian bed was all over ſhining with tortoiſe ſhell on the outſide, and ſwelling with ſtuffing of down within. The immenſe uſe made of it in Rome may be gueſſed at by what we learn from Velleius Paterculus, who ſays, that when Alexandria was taken by Julius Cæſar, the magazines or warehouſes were ſo full of this article, that he propoſed to have made it the principal ornament of his triumph, as he did ivory afterwards, when triumphing for having happily finiſhed the African war. This too, in more modern times, was a great article in the trade to China, and I have always been exceedingly ſurpriſed, ſince near the whole of the Arabian gulf is comprehended in the charter of the Eaſt India Company, that they do not make an experiment of fiſhing both pearls and tortoiſes, the former of which being ſo long abandoned, muſt now be in great plenty and excellence; and a few fiſhers put on board each ſhip trading to Jidda, might ſurely find very lucrative employment, with a long-boat or pinnace, at the time the veſſels were ſelling their cargo in the port; and, while buſied in this gainful occupation, the coaſts of the Red ſea might be fully explored."

Frog.

37. Testudo ———, *Green-ſhelled Turtle. La Tortue Ecaille Verte* of Cepede.

Specif. Char.—Shell green and variegated.

This ſpecies, in general, reſembles the common green turtle, both in appearance and manners; but is diſtinguiſhed from it in having a ſmall rounded head, and never growing to ſo large a ſize. It derives its name from the colour of the ſhell, which is of a fine green, beautifully tranſparent, and although it is thin, may be applied to many ornamental purpoſes.

The green-ſhelled turtle is a native of the ſouth ſeas, and is found near the American rivers within the torrid zone. It is found particularly in great abundance near Cape Blanco in New Spain. The fleſh is in great eſtimation, and is even preferred by ſome to that of the green turtle.

38. *Trunk Turtle.*

This ſpecies is mentioned by Cateſby, who ſays that he never ſaw it; but from information he has deſcribed the upper ſhell as being more convex than in any other ſpecies. It is ſaid that it grows to a very large ſize.—The fleſh is rank; but it yields a great quantity of oil, on which account only it is valued.

39. *Rhinoceros Turtle.* Cepede.

This ſpecies alſo bears a ſtrong reſemblance to the common turtle; but it is diſtinguiſhed from it in having a large ſoft tubercle on the tip of the ſnout, and in this are placed the noſtrils.

This turtle is ſaid to be a native of the American ſeas, within the torrid zone, and is eaten in the ſame way as the common turtle.

II. RANA, Frog.

This genus has been divided by ſome naturaliſts into three genera; and undoubtedly there is ſome foundation for this diſtinction, both from the form and ſtructure of their bodies, and from their manners and habits. 1. The *ranæ* or *frogs*, properly ſo called, and by the French *grenouilles*, have light active bodies, and are furniſhed with ſtrong limbs, which enable them to perform their motions by leaping. 2. The *hylæ*, in French *rainettes*, or tree-frogs, have ſlender limbs, and have ſoft tubercles on the toes, by which they can adhere to ſmooth ſurfaces,

Frogs. faces, as to the leaves of trees on which many of them reside. 3. The *toads* or *bufones*, in French, *crapauds*, which constitute the third genus or division, have large heavy bodies, thick short limbs, and a slow crawling motion. But without multiplying genera, we shall consider the whole under one, distributing them into three sections, according to the division which we have just mentioned.

Sect. I. RANÆ, or *Frogs*.

1. RANA TEMPORARIA, *Common Frog*.

Specif. Char.—Colour yellowish brown, spotted with black; a lengthened brown patch beneath the eyes.

Of all the European species this is the most common. The general colour is of an olive brown, variegated on the upper parts of the body, with irregular blackish spots. The patch beneath each eye, which reaches to the setting on of the fore legs, seems to constitute one of the principal specific distinctions. The under part of the body is of a pale greenish colour, and but obscurely spotted. But it ought to be observed, that the colour of the frog varies at different seasons of the year, and perhaps in different places. Towards the end of summer, for instance, the colours are much brighter; and as this species frequently casts its skin, the cuticle falling off irregularly from different parts of the body, produces considerable variations in the intensity of the colours.

The frog has a light elegant form, and a lively appearance; the limbs are well calculated for its peculiar motions, and the hind feet being strongly webbed, enable it to swim well. The frog, it is said, does not reach its full size till it is five years old, and it lives from 12 to 15 years. It retires during the heat of summer to the water, and in winter it becomes torpid, and is generally found in the soft mud at the bottom of stagnant waters, or in the cavities beneath their banks, where it remains till the return of spring.

The frog, as well as many other of the reptile tribe, is extremely tenacious of life. It survives for a considerable time, the loss even of some of its essential organs, and it has been found to exist for several days when entirely confined under water.

History of the tadpole. The frog deposits its spawn in the month of March. This is composed of a gelatinous transparent mass, including the ova or eggs, in each of which is imbedded the embryo or tadpole, which has then the appearance of a round black globule. The period of hatching varies according to the temperature of the season, but it is commonly about a month or five weeks. In its progress the egg becomes gradually larger, and before the tadpole is excluded, it is seen in motion within the surrounding gluten. When they are first hatched, their only food is the remains of the gluten in which they were included. A few days afterwards, if they are minutely examined, a pair of ramified branchiæ, or temporary organs, may be observed on each side of the head, which after a short time disappear. The tadpole, which is so extremely unlike the animal in its perfect state, seems to consist only of a head and tail. The head is large, black, and roundish; the tail is slender, and margined with a broad transparent fin. The motions of the tadpole are very lively. Its food consists of duckweed and other small water plants, with different kinds of animalcula. The mouth is furnished with very minute teeth, and when the tadpole has reached a certain size, it may sometimes be heard gnawing the edges of the leaves on which it feeds. By means of a sucker placed between the lower jaw, with which the animal in this state is furnished, it can attach itself at pleasure to the under surface of aquatic plants. When it is very young, it sometimes hangs from this part by means of a glutinous thread, similar to some small slugs. Frogs.

Structure and changes. The internal structure of the organs of the tadpole is very different from that of the future animal. In no respect is this difference greater than in the disposition of the intestines, which are coiled in the form of a flat spiral, like a cable. The first change which appears on the tadpole is at the end of five or six weeks after it is hatched. It is about this time that the hind legs first appear; and gradually increasing in length and size, they are succeeded about two weeks afterwards by the fore legs. These latter, indeed, are formed at an earlier period beneath the skin, and are sometimes protruded and again drawn back by the animal, through a small hole on each side of the breast, before their complete evolution. The tail now gradually decreases, and afterwards more rapidly, so that in the space of a day or two it is quite obliterated. After this change, the animal leaves the water, and covers the banks in myriads. The sudden appearance of such multitudes of young frogs, has probably induced the groundless but popular belief, of their having fallen from the clouds in showers. The frog having now arrived at its perfect form, it changes entirely the nature of its food. It lived formerly on vegetables, now it depends solely for its existence on animal food. It lives chiefly on small snails, worms, and insects. To seize its prey, the structure and position of the tongue are remarkably well fitted. It is of considerable length, and it is attached to the fore part of the mouth, and when at rest it lies backwards. The extremity is bifid, and secretes a glutinous matter, so that in this way it can secure its prey, by darting out its tongue with great celerity, and to some distance from the mouth. This it does with so instantaneous a motion, that it is scarcely perceptible to the eye.

2. RANA ESCULENTA, *Green Frog*, or *Edible Frog* of Pennant.

Specif. Char.—Olive colour, spotted with black, with three yellowish lines on the back; abdomen whitish.

This is the largest species of the European frogs. The general appearance resembles that of the preceding; but it is larger in size, and of an olive-green colour, strongly marked on the upper part of the body with roundish black spots. The limbs are elegantly marked with transverse bands of the same colour. Three distinct pale yellow stripes run from the tip of the nose down the whole length of the back, the middle one being slightly depressed; but the two lateral ones are considerably elevated. The head is proportionally larger than that of the common frog.

The green frog is rare in England, but is very common in France, Italy, and Germany, where it is employed as an article of food.

This species, it is observed by naturalists, does not

Frogs. leave its winter retirement till a much later period than the common frog; and in thoſe countries where it is uſed as food, it is worth while to attend to this fact, for if they are pretended to be brought to market at an earlier period, the common frog, and ſometimes even toads, muſt be ſubſtituted. During the breeding ſeaſon, the croaking of the male is ſo loud, that it may be heard at a great diſtance; and in thoſe places where they are numerous, it becomes ſo intolerable to thoſe who are unaccuſtomed to hear them, that they are often deprived of ſleep. At this time, too, a large inflected globular veſicle is protruded from each ſide of the head of the male. The globules of ſpawn in the green frog are proportionally ſmaller than in the former ſpecies. They have ſomewhat of a yellowiſh caſt. The progreſs of the tadpole, towards the evolution of the perfect animal, is conſiderably ſlower in this ſpecies. The fore legs do not appear before October, and the animal does not aſſume its perfect ſhape till the beginning of November. The tail at this time begins to decreaſe, and in the ſpace of four days entirely diſappears.

This ſpecies is extremely voracious, ſeizing, it is ſaid, on young birds of different kinds, mice, and even ducklings, and, as it does with the reſt of its prey, ſwallowing them whole. At the age of four years it has reached its full growth. It begins to breed the year following, and the period of its life is ſometimes extended to ſixteen years.

3. Rana Pipiens, *Piping Frog.*

Specif. Char.—Olive-coloured, with ovate black ſpots, edged with yellow.

This ſpecies is ſmaller than the green frog, but in its general habit bears a conſiderable reſemblance to that animal. From the noſe to the tips of the hind feet, it meaſures only five or ſix inches. The body and limbs are of a duſky green, ſpotted with black. Two yellow lines run from the eyes to the rump, and two white lines from each eye to the noſe. In the living animal the ears have a bright golden colour.

It is a native of North America. It frequents rivulets and ditches of water, and is ſo ſtrong and vigorous, that it is ſaid it can leap to the diſtance of five or ſix yards. In the ſpring and beginning of ſummer, it is ſuppoſed to indicate the approach of rain, by a peculiar ſound which it emits.

4. Rana Catesbeiana, *Bull Frog.*

Specif. Char.—Olive brown, ſpotted with black; large ocellated ſpots near the ears; hind feet palmated.

This ſpecies grows to a very large ſize, meaſuring, it is ſaid, more than 18 inches from the tip of the noſe to the end of the hind feet. The upper part of the body is browniſh, and ſomewhat irregularly marked with numerous ſpots of a deeper brown. The under parts are of a whitiſh caſt, with a ſhade of yellowiſh green. They are alſo marked with numerous ſpots; but theſe are leſs bright than thoſe of the upper part.

The bull frog is a native of many parts of North America. It derives its name from the ſound of its voice, which reſembles the diſtant lowing of cattle. It uſually frequents ſprings; and in Virginia, where theſe abound in the ſides of the hills, a pair of theſe frogs are uſually ſeen ſitting on the edge of the ſmall pond formed by the running of the water from the ſpring; and when they happen to be ſurpriſed, they retreat to the mouth of the ſpring, and, entering it, find themſelves in ſafety. In Virginia, too, a popular opinion prevails, that they are uſeful in purifying the water of the ſpring. This opinion is greatly in their favour, and ſaves them from that perſecution with which the frog and other reptiles are wantonly and unneceſſarily haraſſed in other countries. But the bull frog being extremely voracious, and ſometimes devouring young ducks and goslings, is occaſionally devoted to deſtruction. Frogs.

5. Rana Ocellata, *Argus Frog.*

Specif. Char.—Feet having each five toes, and unwebbed; toes tuberculated beneath; back faſciated, and ſides ocellated.

This is one of the largeſt of the genus, exceeding, perhaps, the bull frog in the ſize of its body, but having limbs proportionally thicker and ſtronger. It has ſometimes been confounded with the bull frog; but it is diſtinguiſhed from it in its general appearance, and particularly in the form of the feet.

This frog is a native of Pennſylvania, Carolina, and other parts of North America, frequenting moiſt places in the vicinity of ſprings and rivulets. In its manners and habits it is ſuppoſed to be nearly the ſame with the bull frog.

6. Rana Virginica, *Lineated Frog.*

Specif. Char.—Cinereous, ſpotted with red; beneath yellowiſh; back angular, and marked with five pale ſtripes.

This ſpecies, in ſhape, ſize, and ſtructure of the feet, reſembles the common frog. It is greeniſh above, and paler beneath. The back and limbs are variegated with dark-brown marks of different ſizes.

It is a native of Virginia.

7. Rana Ovalis, *Oval Frog.*

Specif. Char.—Colour browniſh, beneath yellowiſh; the head beaked, and ſcarcely diſtinct from the globoſe body.

The ſnout projecting beyond the lower jaw, conſtitutes the ſpecific character. The hind legs are ſhort, the feet unwebbed, and there is a callus at the baſe of the inner toe. Its native country is unknown.

8. Rana Cyanophlyctis, *Studded Frog.*

Specif. Char.—Browniſh blue, having a tuberculated line on each ſide; beneath whitiſh, ſpotted with brown.

In this ſpecies the legs are banded with blackiſh blue and white. In the upper jaw there is a row of thickſet conical teeth, reſembling thoſe of lizards. The hind feet are webbed, and furniſhed with a callus like a ſixth toe.

It is a native of India.

9. Rana Spinipes, *Spiny-footed Frog.*

Specif. Char.—Brown, beneath bluiſh; ſides ſpeckled with

Frogs.

with an ochreous colour; toes of the fore feet furniſhed with ſpines.

This ſpecies is larger than the common frog. The feet are unwebbed, and in its habit it approaches to the toad.

It is a native of New Holland.

10. RANA CERULEA, *Blue Frog.*

Specif. Char.—Blue, ſpeckled, with grayiſh beneath; feet divided into four toes; hind feet webbed.

The blue frog is of the ſize of the common one. The toes are not orbiculated; but in its habit and ſlender limbs it approaches ſomewhat to the tree frogs.

It is a native of New South Wales.

11. RANA VESPERTINA, *Veſpertine Frog.*

Specif. Char.—Cinereous, and tuberculated above; a tranſverſe ſpot between the eyes, and forked behind; marked with longitudinal, ſubconfluent, brown dorſal ſpots, which vary into green.

In this ſpecies the head is ſhort, and the body is covered with warts or papillæ. It is about the ſize of a toad, having the habit of a frog. It can ſcarcely be ſaid to leap.

It is a native of Siberia.

12. RANA RIDIBUNDA, *Laughing Frog.*

Specif. Char.—Cinereous, the body ſpotted with brown, the thighs duſky, with milk-white ſpots.

This ſpecies is of a very large ſize, weighing half a pound. It has the habit of the common frog, but is broader.

It is very frequent about the rivers Wolga and Ural, and the Caſpian ſea. It never leaves the water. In the evening it emits a ſound, ſomewhat reſembling a hoarſe laugh, whence it derives its ſpecific name.

13. RANA SITIBUNDA, *Thirſty Frog.*

Specif. Char.—Glaucous gray, variegated with blackiſh green ſpots; beneath whitiſh; the hind feet ſemipalmated, and having the appearance of ſeven toes.

The body is warted, the head ſhort, and has the general habit of a toad, but is larger. There are two curious toes on the hind feet.

It is a native of deſert places about the river Ural. It conceals itſelf during the day.

14. RANA LEVERIANA, *Leverian Frog.*

Specif. Char.—Duſky blue, whitiſh beneath; hind feet palmated, body marked above, with two long and two ſhort white ſtripes.

Excepting that the body is plumper, and the limbs proportionally ſhorter, this ſpecies has the habit of the common frog. On the back of the head there is a ſmall trifurcated ſpot, two upper diviſions of which point forwards. The lower ſurface of the body is yellowiſh white and granulated. The fore feet have four toes, which are ſlightly orbiculated at the tips.

Its native country is unknown.

15. RANA IGNEA, *Fire Frog.* *Rana Bombina*, Lin. Frogs

Specif. Char.—Olive brown, orange colour beneath, ſpotted with blue.

This is the ſmalleſt of the European frogs, and is not equal even to the tree frog in ſize. It derives its name of fire frog from the peculiar colour of the under ſurface of the body; but this is ſubject to conſiderable variation.

It is a native of Germany, Italy, and other parts of Europe, but has not been found in England. It frequents turbid ſtagnant waters, and ſcarcely ever appears on land. It breeds at the age of three years, and may therefore be ſuppoſed to live about ten. It depoſits its ſpawn in the month of June, and the ova are proportionally larger than thoſe of others. The tadpoles, which are of a pale yellowiſh brown colour, are hatched towards the end of June. When young, they have been frequently obſerved to hang from the ſurface of leaves by means of a glutinous thread, iſſuing from the ſmall tube near the lower lip. About the end of September they are at their full ſize. At that time the tail appears more fleſhy and muſcular, and therefore proportionally ſtronger than in other tadpoles. In the beginning of October they aſſume their perfect form.

This is one of the moſt active and lively of the whole genus. It leaps and ſwims even with greater celerity than the common frog. When it is ſurpriſed on the land, and finds that it cannot eſcape, it ſquats down cloſe to the ground, turning back its head and limbs in a ſingular manner. If it be farther diſturbed, it emits from the hinder part of the thighs a frothy kind of fluid which has no diſagreeable ſmell, but ſome degree of acrimony when it comes in contact with the eyes and noſtrils. The ſound emitted by the male of this ſpecies is ſharper than that of other frogs, and ſomewhat reſembles a kind of laugh, or according to ſome, the note of a cuckoo or the tone of a bell. Hence the Linnæan ſpecific name, *rana bombina.*

16. RANA SALSA, *Saline Frog.*

Specif. Char.—Colour olive brown, whitiſh beneath, with duſky variegations: all the toes are unwebbed.

When this ſpecies is firſt taken out of the water, the brown colour has a ſhade of blue; the back is beſet with tubercles; the legs are faſciated with brown, and the inſides of the feet are yellow.

It is a native of the ſalt marſhes of ſome parts of Germany.

17. RANA PARADOXA, *Paradoxical Frog.*

Specif. Char.—Yellowiſh and olive-coloured; variegated with rufous bands; hind legs obliquely ſtriated.

This ſpecies reſembles in its general form the common frog. The oblique longitudinal ſtripes on the hind legs conſtitute the principal mark of diſtinction. There are four toes on the fore feet, and they are unwebbed. The hind feet have five toes, and are deeply palmated to the very ends of the toes. Near the ſhorteſt toe there is an oblong callus, forming a ſpurious one. The upper jaw is beſet with a row of ſmall denticulations.

This ſpecies is a native of South America, and is more common in Surinam than in other places.

Naturaliſts have been extremely puzzled with regard to the real nature of what has been taken for the tadpole of this frog. At one time it was conſidered by Linnæus as a ſpecies of lizard, and therefore arranged by him under the genus *Lacerta*. At another time he has placed it under the preſent genus, with the ſpecific name *piſcis*. It was deſcribed by Edwards under the denomination of the *frog fiſh of Surinam*. The ſtructure of the animal, which has been the ſubject of ſo much diſcuſſion, ſhews clearly that it is the larva or tadpole of a frog; and it is ſuppoſed, with no ſmall degree of probability, that the differences in the accounts given of this animal by naturaliſts have ariſen from the different ſtages of its progreſs in which it has been found. But as this tadpole is ſo much larger in ſize, in proportion to the perfect animal, than any other ſpecies yet known, it may be the larva or tadpole of ſome of the larger ſpecies, and not that of the rana paradoxa, which is but a ſmall frog.

Sect. II. Tree Frogs.

Tree frogs have ſlender bodies, long limbs, and the tips of the toes are flat, orbicular, and dilated. The ſpecies included under this ſection have been formed, according to the arrangement of ſome naturaliſts, into a ſeparate genus, under the name of *Hyla*; and no doubt the peculiar ſtructure of the toes, which enables them to adhere to ſmooth bodies, affords a very ſtriking character, and in ſome meaſure warrants the arrangement.

18. Rana Zebra, *Zebra Frog. Rana Maxima*, Linn.

Specif. Char.—Yelloviſh and rufous, ſpotted and faſciated with brown. There are double bands on the legs, and the feet are palmated.

This ſpecies is the largeſt of the whole of this ſection, meaſuring about five inches from the noſe to the end of the body. The colour is an elegant, pale, rufous brown, beautifully marked on the back and limbs, and even to the very ends of the toes, with tranſverſe cheſnut-coloured bands. The head is large, the eyes protuberant, and the mouth wide. The fore feet have four toes, and the hind ones five.

It is a native of Carolina and Virginia.

Two other ſpecies have been deſcribed by naturaliſts, which more accurate obſervation has ſhewn to be nearly allied to the preceding. The firſt is the *rana boans*, Linn. in which the difference is ſo ſlight, that as Dr Shaw obſerves, it may depend on a ſexual diſtinction. The other is the *rana venuloſa*, which is ſuppoſed to be the ſame animal as the zebra frog, before it has arrived at its full ſize.

19. Rana Bicolor, *Blue-and-Yellow Frog.*

Specif. Char.—Colour blue, ochreous beneath; feet unwebbed; toes flattened and orbicular.

This elegant ſpecies is of a moderate ſize; it meaſures more than four inches in length. The whole of the upper ſurface is of a beautiful blue, while the under parts are of a pale orange or ochre colour. The head is large, the mouth wide, and the tip of the noſe truncated. All the toes are furniſhed with a large orbicular tip; and beneath each of the joints there is a proceſs or tubercle. The upper parts of the female have a deeper ſhade of violet than thoſe of the male.

It is ſuppoſed to be a native of Surinam.

20. Rana Leucophyllata, *White-Leaf Frog.*

Specif. Char.—Colour rufous, variegated above, with ſnow-white ſpots of different ſhapes.

The variegated ſpots on the body and limbs are milk-white, and are obſerved to vary greatly in different individuals, in number, form, and diſpoſition. The toes of the fore feet are ſlightly webbed at the baſe.

It is a native of America.

21. Rana Quadrilineata, *Four-Lined Frog.*

Specif. Char.—Colour blue, having a double, longitudinal, yellow line on each ſide of the body.

This ſpecies bears a near reſemblance to the preceding, but the blue colour above, and the double yellow line, which runs along each ſide of the body, from the eyes to the vent, ſufficiently diſtinguiſh it.

Its native country is unknown.

22. Rana Castanea, *Cheſnut Frog.*

Specif. Char.—Cheſnut-coloured and granulated; whitiſh beneath, with a white line on each ſide of the body.

In this ſpecies, the whole of the upper ſurface, both of body and limbs, is ſcattered over with minute warts or tubercles. On each ſhoulder there is a large, long, white ſpot; the fore arms, hind legs and thighs are barred tranſverſely with white; the feet are unwebbed, the toes rounded, and all the joints tuberculated beneath.

It is ſuppoſed to be a native of Surinam.

23. Rana Fasciata, *Faſciated Frog.*

Specif. Char.—Colour rufeſcent, with whitiſh tranſverſe bands.

In this ſpecies the colour is pale rufous; the head, body, and upper parts of the limbs, are marked with pale, tranſverſe bands; the eyes are blue, with a ſilvery luſtre; the outſide of the arms and legs are of a blackiſh brown colour.

Its native place is unknown.

24. Rana Arborea, *Tree Frog.*

Specif. Char.—Colour green, whitiſh beneath, with a blackiſh lateral line and granulated abdomen; feet unwebbed.

This ſpecies is of a ſmaller ſize than any other of the European frogs. The colour of the upper part of the body is green; the abdomen is whitiſh, and marked with numerous granules. The under ſurface of the limbs is reddiſh, and on each ſide of the body there is a longitudiual blackiſh or violet-coloured ſtreak, which ſeparates the green of the upper parts from the white of the lower. The lower edge of the dark lateral ſtripe is ſhaded with yellow. The hind legs are long and ſlender. There are four toes on the fore feet, and five on the

Frogs. the hind feet. All of the toes terminate in flat, round, and dilated tips. It is by means of this peculiar ſtructure that the animal is enabled to hang from the leaves of trees, or from any ſmooth ſubſtance; for the under ſurface of theſe tips or tubercles on the toes is ſoft and glutinous. There is a ſimilar ſtructure on the ſkin of the abdomen.

The tree-frog is a native of France, Germany, Italy, and other parts of Europe. It has never been found in the Britiſh iſlands. During the ſummer months, it chiefly frequents the upper parts of trees, and wandering among the leaves in ſearch of inſects, it ſeizes them with extreme celerity. It ſteals ſoftly towards its prey, and when it has reached the proper diſtance, it makes a ſudden ſpring of more than a foot in height. For this it is peculiarly fitted, from its nimble and active movements. It conceals itſelf beneath the ſhade of the leaves, by attaching itſelf to their under ſurface by means of the feet, or abdomen.

On the approach of winter, the tree frog leaves the woods, and retires to the waters, where it buries itſelf in the ſoft mud, or conceals itſelf beneath the banks, where it remains torpid till the ſpring, when it depoſits its ſpawn in the water. At this time the throat of the male is greatly inflated, and the loud ſharp croak which it then emits, is heard at a very conſiderable diſtance. The ſpawn is depoſited in ſmall cluſtered maſſes, about the end of April, and the tadpoles aſſume the form of the perfect animal about the beginning of Auguſt, at which time they begin to aſcend the neighbouring trees, where they reſide while the warm ſeaſon continues. It has been obſerved that they are more noiſy on the approach of rain; and the males particularly, if kept in glaſſes, and furniſhed with food, afford certain indications of the changes of the weather.

25. Rana Meriana, *Merian Frog.*

Specif. Char.—Colour yelloviſh green, variegated with brown, with conically ſhaped, auricular veſicles.

This ſpecies is three times the ſize of the common tree frog, and on each ſide of the neck there is a remarkable protuberance like an obtuſely conical, inflated pouch.

This ſpecies is ſometimes found on trees, and ſometimes in the water, according to the different periods of its growth. According to Madame Merian's deſcription, theſe frogs are found in ſtagnant waters. They have, ſhe obſerves, ears in their heads, and knobs or balls on their feet, which have been given them by nature to enable them to paſs eaſily over the moraſſy places which they inhabit.

26. Rana Aurantia, *Orange Frog.*

Specif. Char.—Orange-coloured; body and limbs very ſlender.

This ſpecies is entirely of a reddiſh orange colour, long-limbed and ſlender-bodied. It is ſmaller than the European tree frog.

It is a native of South America, inhabiting trees.

27. Rana Tinctoria, *Tinging Frog.*

Specif. Char.—Of a reddiſh colour; the body faſciated with white.

Toads. It is of a bright red or ferruginous colour above, marked longitudinally with a pair of white ſtripes. Theſe at an early age are often croſſed with a tranſverſe ſtripe; and indeed the individuals of this ſpecies have been found to vary greatly in the diſpoſition of the colours.

It is a native of South America, and inhabits trees.

The Indians employ this ſpecies of frog to change the colour of green parrots. For this purpoſe they pluck the feathers from that part of the parrot on which they wiſh the new colour to be introduced. They rub the ſkin with the blood of the animal, and the renovated feathers, inſtead of being green as formerly, are yellow or red.

28. Rana Alba, *White Frog.*

Specif. Char.—Entirely of a white colour.

On the upper part of the body there are ſome ſpots or patches, which are of a brighter white than the ground. It is, however, ſubject to ſome variations.

It is a native of the woods in the warmer parts of North America.

29. Rana Bilineata, *Bilineated Frog.*

Specif. Char.—Colour green, with a ſtraight yellow line on each ſide of the body.

The only difference between this ſpecies and the common tree frog is, in the yellow line on each ſide of the body of the former being ſomewhat ſtraighter, and without undulations.

It is a native of the warmer parts of North America, inhabiting the woods.

Sect. III. Toads.

30. Rana Bufo, *Common Toad.*

Specif. Char.—Colour brown, with reddiſh brown tubercles, pale beneath.

The common toad is too well known to require any detailed deſcription. The colour is generally of an obſcure brown above, but much paler, and irregularly ſpotted beneath. It is, however, ſubject to conſiderable variations, being ſometimes found of an olive cait; and in the earlier part of ſummer, the ſhoulders and limbs are marked with reddiſh ſpots, while the under parts of the body have a yelloviſh tinge. The body is always covered with puſtules or tubercles of a darkiſh green, or bright red colour, and they are of different ſizes in different individuals. The common toad is not only a native of Europe, but of other countries of the world.

History of the toad. The common toad uſually frequents ſhady places, in gardens or fields; is found under ſtones, or makes its way into cellars or other obſcure receſſes, anxious, as it would ſeem, to conceal itſelf, or, that it may lie protected from exceſſive cold, and find a ſupply of food. The toad, like the common frog, becomes torpid in winter; and it would appear, that they ſometimes collect together in numbers, and take up their habitation in the ſame hole or cavity, with the view of preſerving and retaining their heat for a greater length of time. At the return of ſpring, the toad leaves its lurking place, and retires to the waters, where it depoſits its ſpawn.

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ſpawn. The ova are included in a tranſparent gluten, which is in the form of chains or ſtrings, ſomewhat reſembling a necklace. The length of theſe ſtrings is from three to four feet; and through the whole length the ova, which have the appearance of black globules or beads, are diſpoſed in a double ſeries. The tadpole is hatched at the end of 14 or 15 days, according to the temperature of the ſeaſon; and having burſt from the ſurrounding gluten, they ſwim about in the water, feeding on different animalcules, and leaves of water plants. Early in the autumn they aſſume the form of the perfect animal, when they retire from the water, and are ſometimes found in ſuch numbers on the ground in its vicinity, that it has probably given riſe to the common opinion of their having fallen from the clouds in ſhowers.

Age.

The age of the toad is ſuppoſed to be about 15 or 20 years, but ſometimes they exceed this period. One, of which Mr Pennant has given an account in his Britiſh Zoology, lived to the great age of 40 years. This individual had been known for that time in a domeſticated ſtate. It was kept by a Mr Aſcot in Devonſhire, and had become ſo tame, that it left its hole at the approach of its maſter, to receive food. It grew to a very large ſize, and had become an object of ſo much curioſity, that in ſpite of the averſion and horror which this animal uſually inſpires, it was viſited by all, and even by ladies, who came to the houſe. It was frequently brought to table, and fed with inſects, and without any degree of embarraſſment, or ſeeming deſire to get away, it ſeized them with great celerity. Its uſual place of reſidence was under the ſteps of the door of the houſe which led to the garden. It was unfortunately ſeized by a raven, and ſeverely wounded, before it could retreat to its hole; and although it was liberated from its enemy, and lived for more than a year afterwards, it never recovered its uſual health and vigour, otherwiſe the period of its life might have been greatly extended.

It has been long ſuppoſed that the toad, when it is irritated, ſecretes a fluid from its ſkin which is of a poiſonous quality. This fluid, however, has no effect whatever, except producing a little irritation, on larger animals. A dog, it has been obſerved, carrying a toad for a ſhort time in his mouth is affected with a ſlight ſwelling of the lips, and an increaſed diſcharge of ſaliva. This fluid undoubtedly anſwers ſome purpoſe in the economy of the animal, and it is probably intended for its protection againſt the troubleſome attacks of ſmaller animals. This ſeems to be in ſome meaſure proved from the experiments of Laurenti. In theſe experiments it appeared that ſmall lizards which had bitten the common toad, became diſordered, and paralytic, and even apparently dead. They were, however, completely recovered in the ſpace of a few hours.

Not poiſonous to large animals.

Many wonderful ſtories have been related of the toad having been found incloſed in the ſolid ſubſtance of wood and ſtone, or marble; and what is ſtill more wonderful, that it has been in ſuch circumſtances without any viſible outlet, or the ſmalleſt paſſage for the acceſs of air, alive, and ſeemingly uninjured. It is not indeed a little ſurpriſing, that a ſuppoſed fact of this kind, ſo contrary to the nature of animal exiſtence, ſhould even for a moment have gained any degree of belief; yet many ſuch ſtories have been currently reported, and readily, we might almoſt ſay, univerſally admitted to be true; for being eſtabliſhed on what was ſaid to be the moſt undoubted teſtimony, they were received and acknowledged as fully authenticated. But on cloſer inveſtigation, in all caſes where inquiry could be made, it was found that ſome links in the chain of evidence were always wanting. In no inſtance whatever, it may be aſſerted, has the fact been aſcertained from direct information, founded on any credible or reſpectable authority. It has always been firſt communicated by report, or from a diſtance; circumſtances which always give room for miſtake and error. Toads may have been found incloſed in wood, or even in ſtone, perhaps without having received any material external injury; but that they ſhould have remained in ſuch ſituations for any great length of time, as for years, nay, in ſome caſes, for hundreds of years, totally deprived of food, and completely excluded from all acceſs of air, is not only highly incredible, but impoſſible. But if farther evidence were neceſſary, this ſuppoſed fact is fully diſproved by the experiments of Heriſſant, which he performed in preſence of the French Academy. It had been aſſerted that a living toad was found in the year 1771, in a wall at a ſeat belonging to the duke of Orleans. The wall, which was then pulled down, had been built 40 years; and its hind feet were found imbedded in the mortar. In Heriſſant's experiments, three toads were incloſed in ſeparate boxes, and theſe were immediately covered with a thick coat of mortar, and kept in the apartments of the academy. At the end of 18 months the boxes were opened, and two of the toads were found living. They were again encloſed; but being re-opened after ſome months had elapſed, they were found dead.

Error concerning its being found alive encloſed in ſolid ſubſtances.

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31. Rana Alliacea, *Alliaceous Toad.*

Specif. Char.—Colour pale gray, marked with brown, and having a whitiſh dorſal line; pupils perpendicular.

This ſpecies, excepting in a greater proportional length of the head, has a conſiderable reſemblance to the common toad. It differs from it alſo in being nearly ſmooth. The colour above is a browniſh gray, with ſpots of deep brown, which on the ſides are diſpoſed in a reticular form. The eye has a very peculiar ſtructure. The form of the pupil, when the eye is contracted, is perpendicular, as in the eyes of cats. On the hind feet there is a ſpurious claw, or horny callus, ſituated beneath the heel.

This animal gives out, when irritated, a peculiar odour, which reſembles that of onions or garlic, and produces a ſimilar acrid effect on the eyes. A ſmell like that of the ſmoke of gunpowder is alſo ſometimes combined with the garlic ſmell.

This ſpecies is a native of Germany. It is found in the neighbourhood of Nuremberg.

It has been already mentioned, that the ſpawn of the common toad is depoſited in the form of a double ſtring; but in this ſpecies there is only one ſtring, which is of conſiderable thickneſs, and the numerous ova are diſpoſed, not in a double row, as in the former, but in a confluent manner through the length of the ſpawn, which is ſometimes found nearly two feet long.

The tadpole of the alliaceous toad, like the ſuppoſed one of the *rana paradoxa*, is conſiderably larger in ſize than the young frog when it has firſt aſſumed its perfect form.

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form. Indeed it is ſo large, that in the vicinity of the places where it is found, it is employed as food by the country people, who conſider it as a kind of fiſh. It ſeems alſo to be one of the moſt voracious tadpoles.

The alliaceous toad, contrary to the habits of the common toad, remains almoſt conſtantly in water, and but very rarely appears on land. It is alſo more lively and active in its nature, and its motions are performed by a kind of leaping, rather than by the crawling ſluggiſh pace of the latter.

32. Rana Mephitica, *Mephitic Toad.*

Specif. Char.—Colour olive, ſpotted with brown; warts on the ſkin reddiſh; dorſal line ſulphur-coloured.

Excepting in the colour, and being of a ſmaller ſize, this ſpecies greatly reſembles the common toad. The body and limbs are ſhort and thick; the fore feet are furniſhed beneath with a pair of bony proceſſes, by means of which it is enabled to climb up the ſides of walls. The hind feet have no webbed ſtructure. In its motions it runs ſomewhat like a mouſe. It comes out only in the night, from the cavities of walls and rocks, where it conceals itſelf by day.

This ſpecies is a native of Germany, in ſome parts of which it is known by the name of *roerkling*, or reed frog, becauſe in the ſpring it frequents places which are overgrown with reeds. At this ſeaſon, too, it is well known by the ſtrong and peculiar note or croak which it utters.

In the month of June, when this ſpecies breeds, it reſorts to the water, to depoſit its ova. Theſe are emitted, as is the caſe with the common toad, in double rows, in a pair of long glutinous ſtrings; and ſo rapid is the progreſs of hatching, that the tadpoles appear in the ſpace of five or ſix days, having ſeparated themſelves from the ſpawn. The hind legs appear about the end of Auguſt, are ſoon ſucceeded by the fore legs, and by September or October the animal has aſſumed its complete form.

The mephitic toad has derived its name from a moſt offenſive ſmell which it diffuſes when it is irritated. This odour proceeds from a white acrid fluid which exſudes from the pores of the ſkin. The animal has the power of emitting this fluid to the diſtance of three or four feet, and it is ſaid that if it fall on any part of the room where the animal is kept, it will ſcarcely be entirely diſſipated for two months afterwards. This odour reſembles the ſmoke of gunpowder, but is conſiderably ſtronger; or that of the fumes of arſenic.

Var. The natter-jack of Pennant is, according to ſome, a variety of the above ſpecies. It is not, however, ſaid, that, like the mephitic toad, it emits any peculiarly offenſive odour; but its running motions bear a near reſemblance; for it does not leap, nor does it crawl with the ſluggiſh pace of the common toad.

It is a native of England, and is found in Pulteney common, and near Reeveſley abbey in Lincolnſhire, frequenting dry and ſandy places.

33. Rana Viridis, *Green Toad.*

Specif. Char.—Colour pale, varied with greeniſh ſpots; tubercles reddiſh. *Rana variabilis*, Linn.

In this ſpecies the green ſpots or patches are bounded with a blackiſh margin, and the whole has ſomewhat of the appearance of a map. The ſpots on the legs and thighs are tranſverſe, forming a kind of bars; the eyes are remarkable for a beautiful golden colour, and when the animal is irritated, ſeem to emit a kind of phoſphoric light.

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This ſpecies is a native of Germany and other parts of Europe, and is not unfrequently found about Vienna, where it inhabits the cavities of walls.

This ſpecies, like the mephitic toad, emits a very ſtrong odour, which reſembles that of garden nightſhade. It is ſo powerful, that it diffuſes itſelf through a large room.

During the breeding ſeaſon this ſpecies frequents the waters, and in winter it retires under ground. Its croaking is ſaid to reſemble the creaking of the hinge of a door. It would appear, that the fluid which exſudes from the ſkin of this toad, and probably alſo from that of others, is poiſonous to ſmall animals; for it is ſaid that the ſmaller kinds of the gray lizard, on biting this toad, became immediately ſtrongly convulſed, and died in a few minutes.

34. Rana Marina, *Marine Toad.*

Specif. Char.—Colour yelloviſh brown, with a large porous prominence over each ſhoulder; very large ſize.

This ſpecies even exceeds the bull frog in ſize. On each ſhoulder there is a protuberance of a light-brown colour, which is marked with many pores. Theſe are the parotid glands, which are peculiarly conſpicuous. The feet have no webs, and there are four toes on the fore feet, and five on the hind. The toes are furniſhed with claws, ſomewhat reſembling the human hair. There are ſome tubercles at the extremity of the body, which are ſaid to be owing to the folding of the ſkin, when the animal is placed in a particular attitude; for theſe diſappear when the attitude is changed.

This ſpecies is ſaid to be a native of America; and, according to ſome, is calculated to live both by land and ſea.

35. Rana Dubia, *Doubtful Toad.*

Specif. Char.—Colour yelloviſh brown, warty, having a large porous prominence over each ſhoulder; hind feet ſubpalmated and ſubhexadactyle.

In ſize this ſpecies comes near that of the common toad; but it is different in ſhape, as it tapers from the ſhoulders to the hind legs like the tree frogs. The upper ſurface of the body is covered with oval tubercles, and there are protuberances on the ſhoulders like the *rana marina*. The under parts of the body are alſo beſet with ſmaller tubercles. The joints of the toes of the fore feet are tuberculated beneath, and there are two remarkable protuberances under the foot.

Of the native country of this ſpecies, or of its manners and habits, nothing is yet known.

36. Rana Typhonia, *Mitred Toad.*

Specif. Char.—Colour brown, dorſal line whitiſh; head triangular.

This ſpecies is about the ſize of the common toad; the

Toads. the thighs are barred with brown, and the ſkin of the whole body is covered with numerous ſmall protuberances of a pearly colour. The ſides of the head beyond each eye have ſomewhat of an angular appearance, and from this it has derived the name of *mitred toad*.

37. RANA BRAZILIANA, *Brazilian Toad.*

Specif. Char.—Colour rufous, with numerous brown ſpots on every part of the body.

In its general appearance this ſpecies reſembles the common toad, but is much larger, and the head is proportionally ſhorter. The ſpots or ſtripes on the body are red brown, placed tranſverſely, and are ſomewhat waved.

It is a native of South America; but, according to ſome, has been found in the iſland of Cuba.

38. RANA VENTRICOSA, *Granulated Toad.*

Specif. Char.—Colour pale brown; abdomen dilated, and marked on the ſides with blackiſh ſpots.

In this ſpecies the head and eyes are large, the mouth wide, the body ſomewhat depreſſed; the abdomen is very broad; the limbs are rather ſhort. The upper ſurface of the body and limbs is covered with tubercles of different ſizes, pretty diſtinctly arranged.

It is ſuppoſed to be a native of Brazil.

39. RANA CORNUTA, *Horned Toad.*

Specif. Char.—Colour cinereous, banded with brown; eyelids conical.

In this ſpecies a broad white band runs along the back, from the head to the extremity of the body, and becoming gradually narrower. It is covered with ſmall ſpecks like pearls. The reſt of the body, excepting the head, is rough, with ſharp points. The head is large and thick, and a broad thick tongue appears when the mouth is opened. It is covered with papillæ, and faſtened to the anterior part of the lower jaw. The gape of the mouth extends almoſt half the length of the body; the eyes are rather ſmall, and are placed nearer than in other frogs. Each of the upper eyelids riſes up into a large conical callus, or horn. From this extraordinary width of the mouth, and ſingular ſtructure of the upper eyelids, this ſpecies exhibits the moſt deformed and hideous aſpect of any of the whole tribe.

It is a native of South America.

40. RANA PIPA, *Pipa*, or *Surinam Toad.*

Specif. Char.—Colour brown; toes of the fore feet quadrifid at the extremities.

This ſpecies is conſiderably larger than the common toad. The body is flattiſh; the head ſomewhat triangular; the mouth wide, and the corners are furniſhed with a kind of rugged appendage. There are four long thin toes on the fore feet, and each of the toes is divided into four diſtinct proceſſes; and theſe, when minutely examined, are found to be ſtill farther divided. The hind feet have five toes, and are webbed to the tips. The male is larger than the female, meaſuring ſometimes ſeven inches from the tip of the noſe to the extremity of the body. The noſe in both ſexes is truncated, and the eyes very ſmall.

Toads.

This ſingular ſpecies is a native of Surinam.

The economy and habits of the pipa greatly occupied the attention of naturaliſts for a long time after it was firſt known to Europeans, which was about the end of the 17th century. It was then ſuppoſed that the ova were produced in cells on the back of the animal, without being firſt excluded, as in the other ſpecies of this tribe, in the form of ſpawn. But future obſervers have added new facts, and greater accuracy to the natural hiſtory of this ſpecies; and it is now found, that the ſpawn being excluded in the uſual manner, is received into a number of open cells on the back of the animal, and is there retained till the young have reached ſome degree of maturity. This diſcovery is owing to Dr Fermin, who made his obſervations on the ſpot, during a reſidence at Surinam. The female pipa, he obſerves, depoſits her ſpawn near ſtagnant water. The male collects the ova, and places them carefully on the back of the female, where, after being impregnated, they are preſſed into the cells, which are then open to receive them. The cells cloſe over them, and retain them for near three months, when the young animals, having arrived at their perfect ſtate, emerge from the back of the parent. During this period of concealment, it has been diſcovered by other naturaliſts, that the ova undergo the ſame change as in thoſe which are hatched out of the body; firſt aſſuming the form of the tadpole, and then acquiring the complete ſhape before they are excluded from the cells. In this mode of hatching its young, ſome naturaliſts have obſerved an analogy in this proceſs of nature between the Surinam toad and the opoſſum.

Ova hatched in a ſingular manner.

This animal, from the uncouthneſs of its ſhape, and its general appearance, will, by many, be conſidered at firſt view as little leſs hideous and deformed than the horned toad.

41. RANA BREVICEPS, *Short-headed Toad.*

Specif. Char.—Colour brown, pale beneath; body ovate, convex, and marked with a longitudinal, aſh-coloured, dentated band. *Rana gibboſa*, Linn.

This is a ſmall ſpecies, and ſcarcely exceeds half the ſize of the common toad. The head is very ſmall, obtuſe, and ſunk in the thorax. The toes of the fore feet are unwebbed, have no claws, and are furniſhed with tubercles beneath the joints. The hind feet are furniſhed with ſix toes.

It is a native of Senegal, and ſome other parts of Africa.

42. RANA SYSTOMA, *Indiſtinct Toad.*

Specif. Char.—Body ſomewhat globoſe; head indiſtinct, and mouth ſmall.

In its general appearance this ſpecies greatly reſembles the preceding. The body is thick and roundiſh, and the head is ſo little diſtinguiſhed from the body, that the mouth is ſcarcely perceptible. The legs are very ſhort, and the thighs ſeem encloſed in the wrinkled ſkin of the ſides. The whole body is ſmooth.

It is a native of the Eaſt Indies.

43. Rana Acephala, *Headleſs Toad.*

Specif. Char.—Colour browniſh, marbled with white; head indiſtinct, and mouth very ſmall, bending downwards.

Excepting in the colour, which is very different, and in the head being ſtill leſs diſtinguiſhed from the body, this ſpecies in appearance comes very near the two former. The mouth alſo is ſmaller, and is curved downwards at each corner. Its native country is unknown.

44. Rana Lentiginosa, *Carolina Toad.*

Specif. Char.—Colour gray, freckled with brown; head ſomewhat pointed.

This ſpecies in its general appearance greatly reſembles the common toad, excepting that the head is ſmaller, and the ſnout ſharper. The colour is of a duſky brown, mottled with minute blackiſh or dark-brown ſpots. In its motions this ſpecies is different from the common toad, for it leaps rather than crawls.

It is a native of North America, and particularly of Carolina and Virginia. It is ſaid to be moſt common in wet weather, and frequents the higher grounds, appearing not only in the evening, but even in the hotteſt part of the day.

This ſpecies, like others of the ſame tribe, feeds on inſects, and ſeems to be extremely fond of luminous inſects, as fire-flies, glow-worms, &c. It is ſaid that it will ſeize a piece of live wood coal, miſtaking it for a luminous inſect, and ſwallow it, ſeemingly with impunity.

45. Rana Semilunata, *Creſcent Toad.*

Specif. Char.—Colour blackiſh, paler beneath; a white creſcent-ſhaped ſpot at each ear.

This ſpecies is larger than the common toad, and is particularly diſtinguiſhed by a large, round, white ſpot behind the parotids. The body is covered above with tubercles.

46. Rana Melanosticta, *Black-lipped Toad.*

Specif. Char.—Colour yellowiſh brown; warts black, ſpeckled; upper lip and eyelids edged with black; hind feet ſubhexadactylous and ſemipalmated.

This ſpecies is nearly the ſize of the common toad, and reſembles it in its general appearance. The ſpace between the eyes is depreſſed and ſmooth. The edges of the projecting orbits of the eyes are black; the upper jaw is ſurrounded with a ſimilar border, and the tips of the toes and the two tubercles of both hind and fore feet are alſo black.

It is ſuppoſed to be a native of China.

47. Rana Arunco, *Arunco.*

Specif. Char.—Body warted; all the feet webbed.

This ſpecies is nearly of the ſame colour as the common frog, but it is larger in ſize. The body is warted, and all the feet are palmated.

It is a native of Chili.

48. Rana Lutea, *Yellow Toad.*

Specif. Char.—Colour yellow; feet ſubpalmated.

In its general habit this ſpecies reſembles the common frog, but is ſmaller in ſize. The ſkin is covered with warts, and all the feet are ſubpalmated.

It is alſo a native of Chili, and frequents the waters.

III. DRACO, Dragon.

Gen. Char.—The body is four-footed, and is furniſhed with a tail: on each ſide there is an expanſile, radiated, wing-like ſkin.

1. Draco Volans, *Flying Dragon.*

Specif. Char.—The fore legs are unconnected with the wings.

The flying dragon, in many reſpects, both in its ſtructure and habits, reſembles the tribe of lizards; but on account of the expanſile cutaneous proceſſes with which the ſides are furniſhed, Linnæus has arranged it under a diſtinct genus.

The body of this animal is about four inches in length; but from the tip of the noſe to the extremity of the tail, it is commonly about nine or ten inches, and ſometimes a foot. The form of the head is very ſingular; it is furniſhed beneath with a large triple pouch or proceſs, one part of which hangs beneath the throat, while the other two project on each ſide. They are all ſharp-pointed, and are more conſpicuous, in proportion to the ſize of this animal, than the ſame proceſſes in lizards. The mouth is wide; the tongue large and thick at the baſe; the teeth are ſmall and numerous; the neck is alſo ſmall; the body and limbs are ſlender, and entirely covered with ſmall pointed ſcales. On the upper part of the body the colour is pale blue, or bluiſh gray; but the back and tail are marked with tranſverſe duſky bars. The wings are elegantly ſpotted with patches of black, deep brown, and white, of different forms. The under ſurface is of a whitiſh-brown colour.

The flying dragon is a native of Aſia and Africa, where it is found frequenting trees; and for this it is peculiarly adapted, from the cutaneous proceſſes with which it is furniſhed on each ſide. For by means of theſe lateral membranes, it is enabled to ſpring with more facility from branch to branch, and even to ſupport itſelf for ſome time in the air, like the bat or flying ſquirrel. Like the lizard, it feeds on inſects.

2. Draco Præpos, *American Flying Dragon.*

Specif. Char.—Wings united with the arms.

This ſpecies is conſidered by ſome naturaliſts only as a variety of the former. The circumſtances in which it differs are, that the body and neck are more ſlender, and the pouch at the throat is ſingle.

It is ſaid to be a native of America.

The real dragon of modern naturaliſts, it may be obſerved, is not that terrible and deſtructive monſter, the mere creature of imagination, which exiſted only in the deſcriptions of romance, and the older poetry; nor is it

Lizards. the animal which we find deſcribed and figured in ſome of the writings of the older naturaliſts. For theſe, it is now well known, are either entirely fictitious beings, or have been prepared artificially, by joining together the limbs of different animals; and thus producing a monſter, under the name of dragon, unknown in nature. This has been done by warping ſome ſpecies of the ſkate tribe, into what was ſuppoſed to be the ſhape of a dragon, and having raiſed the fins, and dried them in this poſition, by adding the legs of birds or other animals. Hence have originated the monſtrous repreſentations, which are found in ſome of the older naturaliſts, of many-headed dragons, having necks and tails like thoſe of ſnakes, and feet like thoſe of birds. Deceptions of this kind, it would appear, have been often ſucceſsfully practiſed, by which means, not only the vulgar, but alſo men of ſcience, have been miſled and impoſed upon. The following is an inſtance of this kind, which happened about the end of the 17th century. It is quoted by Dr Shaw, and he obſerves, is thus commemorated by Dr Grainger from a note of Dr Grey, in his edition of Hudibras, vol. 1ſt. page 125.

"Mr Smith of Bedford obſerves to me on the word dragon, as follows: Mr Jacob Bobart, botany profeſſor (or rather ſuperintendant of the garden) of Oxford, did about 40 years ago, find a dead rat in the phyſic garden, which he made to reſemble the common picture of dragons, by altering its head and tail, and thruſting in taper ſharp ſticks, which diſtended the ſkin on each ſide, till it mimicked wings. He let it dry as hard as poſſible. The learned immediately pronounced it a dragon, and one of them ſent an accurate deſcription of it to Dr Magliabechi, librarian to the grand duke of Tuſcany. Several fine copies of verſes were wrote on ſo rare a ſubject; but at laſt Mr Bobart owned the cheat; however, it was looked upon as a maſterpiece of art, and as ſuch depoſited in the muſeum or anatomy ſchool, where I ſaw it ſome years after."

We ſhall relate another inſtance of an artificial dragon, with which a ſimilar deception was practiſed, and which was detected by Linnæus. This dragon was in the poſſeſſion of a merchant at Hamburgh, and was valued by the proprietor at 10,000 florins. Linnæus, while he was on a viſit to that city, detected the cheat, and ſhewed that it was entirely an artificial animal, compoſed of the ſkins of ſnakes, the teeth of weaſels, the claws of birds, &c. It is even ſaid, that Linnæus having made this diſcovery, was obliged to make a precipitate retreat from Hamburgh, to avoid a proſecution which was threatened by the proprietor on the ſcore of the reputation and value of his property being injured by this diſcovery.

IV. LACERTA, Lizard.

Gen. Char.—The body is four-footed, elongated, and furniſhed with a tail; there is no ſecondary integument.

The numerous genus Lacerta includes a great variety of animals which, although they poſſeſs many characters in common, yet they exhibit conſiderable differences, not only in their economy and habits, but alſo in ſtructure and external form. On this account this genus has been divided by ſome naturaliſts into a number of diſtinct genera. We have here, however, according to the Linnæan arrangement, retained the whole under the ſame genus; but we ſhall divide the ſpecies comprehended under it, as other naturaliſts have done, into different ſections, as follows: 1. Crocodiles; 2. Guanas; 3. Cordyles; 4. Lizards proper; 5. Chameleons; 6. Geckos; 7. Scinks; 8. Salamanders, Newts, or Efts; 9. Snake Lizards. Lizards.

Sect. I. Crocodiles.

The character of the animals included under this ſection is, that they are furniſhed with very ſtrong ſcales.

1. Lacerta Crocodilus, *Common Crocodile*, or *Crocodile of the Nile.*

Specif. Char.—Head mailed; neck carinated; tail furniſhed on the upper part with two lateral creſted proceſſes.

The crocodile ſometimes arrives at a very great ſize. Individuals of 20 feet long have frequently been ſeen, and inſtances are mentioned of ſome which have exceeded the length of 30, and even 40 feet. When it is full grown, the colour of the upper part of the body is blackiſh brown; beneath it is yelloviſh white. The upper parts of the legs and ſides are varied with deep yellow, and in ſome parts tinged with green. The colour of the younger animal is different; for that of the upper parts is a mixture of brown and pale yellow, while the under parts are nearly white. The opening of the mouth is of great width, and exhibits ſomewhat of a flexuous outline. Both jaws are furniſhed with numerous ſharp-pointed teeth; thoſe in the middle part of the jaw being largeſt, and reſembling the canine teeth of viviparous quadrupeds. Each jaw contains 30 teeth or more, for the number is found to vary in different individuals, perhaps from the difference of age. The diſpoſition of the teeth is ſuch, that when the mouth is ſhut, they alternate with each other. When the teeth have been taken out, and the alveoli examined, it has appeared that ſmall teeth were forming beneath, to ſupply the loſs of the others when ſhed. The external openings of the ears are placed on the top of the head, above the eyes; they are of moderate ſize, of an oval form, and covered with a membrane, in which there is a longitudinal ſlit, giving them the appearance of cloſed eyes. The eyes are furniſhed with a nictitating membrane, or tranſparent moveable pellicle, ſimilar to that of birds. The legs of the crocodile are ſhort, ſtrong, and muſcular. There are five toes on the fore feet, and they are unwebbed. On the hind feet there are only four toes, which, towards the baſe, are united by means of a ſtrong membrane. The two anterior toes on each of the fore feet, and the interior one of the hind feet, have no claws; but the other toes are furniſhed with claws, which are ſtrong, ſharp and curved. The tail is long, compreſſed on the ſides, and furniſhed above with an upright proceſs, formed by the gradual approach of two elevated creſts which proceed from the lower part of the back. The upper part of the body of the crocodile is covered with ſtrong armour; which, in its ſtructure exhibits the appearance of a regular and curious carved work, and is indeed a moſt elaborate piece of mechaniſm. It is ſo

ſtrong

Lizards. ſtrong and thick, when the animal has reached its full growth, that it eaſily reſiſts the force of a muſket-ball. On the lower parts of the body, it is more pliable, and much thinner, ſo that it is in theſe parts only that wounds can be inflicted.

The crocodile depoſits its eggs in the ſand or mud, in the banks of the rivers which it inhabits; and as ſoon as the young are hatched, they proceed to the water. When the young are firſt excluded, the head is proportionally much larger than that of the full grown animal. The egg of the common crocodile is about the ſize of that of a gooſe, and reſembles greatly that of a bird. It is covered with a calcareous ſhell, which is lined with a membranous ſubſtance. Various birds, the ichneumon and other animals, make great havock among the eggs of the crocodile during the period of hatching, thus diminiſhing the numbers which would otherwiſe be produced. The eggs of the crocodile, and indeed the fleſh itſelf, are regarded as delicacies among ſome African nations, and compoſe a part of their favourite repaſts.

The crocodile is a native of Aſia and Africa, but it ſeems to be more common in the latter than in the former country. It inhabits the large rivers, as the Nile, the Niger, &c. frequenting the low ſand iſlands of theſe rivers; and preys chiefly on fiſh, although, being extremely voracious, it ſeizes any other animal that comes within its reach.

The crocodile has been long regarded as one of the moſt formidable animals of the countries which it inhabits; but from the accounts of later naturaliſts, it appears, that it is by no means ſo ferocious as has been pretended. Denon, who viſited Egypt along with the French army, obſerves, that many ſtories are related of crocodiles, but that he had not any opportunity of verifying a ſingle one. "Daring, (ſays he) even to imprudence, our ſoldiers ſet them at defiance. Even I myſelf bathed daily in the Nile; for the tranquil nights that I thus obtained, rendered me regardleſs of dangers, which we had not as yet verified by a ſingle fact. If the crocodiles had devoured a few of the carcaſes which the war left at their diſpoſal, ſuch a food, it might be imagined, would only excite their appetite, and engage them to purſue, when alive, ſo favourite a prey. And yet we were never once attacked by them, nor did we ever meet with a ſingle crocodile at a diſtance from the water. Hence it appears probable, that they find in the Nile itſelf a ſufficient quantity of eaſily procurable food, which they digeſt ſlowly, being like the lizard and ſerpent, cold-blooded, and of an inactive ſtomach. Beſides, having in the Egyptian part of the Nile no enemies but each other and man, they would be truly formidable; if, covered as they are, with an almoſt impenetrable defenſive armour, they were alert and ſkilful in making uſe of thoſe which nature has given them for attack *."

* *Travels*, vol. iii. p. 310.

The ſame author obſerves, that no crocodiles were ſeen at Syene on the river Nile, but that they are to be met with above the cataracts. "They ſeem (he ſays) to prefer certain reaches of the river, and particularly from Tentyra to Ombos; they abound moſt of all near Hermontes. We here ſaw three of them; one much larger than the reſt, was nearly 25 feet long: they were all aſleep, ſo that we could approach them within 20 paces, and we had time to diſtinguiſh all the peculiarities which gave them ſuch a hideous aſpect. They reſembled diſmounted cannon. I fired on one with a heavy muſket; the ball ſtruck him, and rebounded from his ſcales. He made a leap of 10 feet, and dived into the river †." Lizards.

† *Ibid.* 136.

In the large rivers of Africa, vaſt ſhoals of crocodiles are ſeen ſwimming together, when they exhibit the appearance of the trunks of large trees floating on the water. It is ſaid that the negroes venture to attack, and often ſucceed in killing a ſingle crocodile, by ſtabbing it with a ſharp inſtrument under the belly, where the ſkin is ſoft and vulnerable. In ſome countries, we are told, the hunting of the crocodile with ſtrong dogs, is practiſed for amuſement. For this purpoſe the dogs are properly trained and inſtructed; and to protect them againſt the attack of the crocodile, they are armed with collars furniſhed with ſpikes.

It is even ſaid, that crocodiles are occaſionally tamed in ſome parts of Africa, and that they conſtitute an article of royal magnificence with ſome of the African monarchs, in which caſe, they are kept in large ponds or lakes. It is well known that crocodiles were exhibited by the ancient Romans during their public ſpectacles. In the edileſhip of Scaurus, he preſented the people with a fight of five crocodiles in a temporary lake; and one was introduced by Auguſtus in his triumph over Cleopatra, for their entertainment.

Var.—A variety of the common crocodile, it is ſaid, has been found in the river Senegal; according to M. Adanſon, it has a longer ſnout, and is almoſt entirely black. It is ſaid that it is very rapacious, and has only been obſerved in the above river, where the common crocodiles are very numerous.

2. LACERTA ALLIGATOR, *the Alligator* or *American Crocodile.*

Specif. Char.—Head flat, imbricated; neck naked, or uncarinated; tail furniſhed above with two lateral lines.

The alligator is conſidered by ſome naturaliſts only as a variety of the crocodile; any differences which are obſervable, they ſuppoſe, may be aſcribed to the effect of climate. They have the ſame number of teeth, and their manners and habits are nearly ſimilar in the old and new world; but the difference, although not at firſt ſight obvious, ſeems to be fully eſtabliſhed from the more accurate obſervations of others. The head of the alligator is ſmooth, and is not furniſhed with the rugoſities and hard carinated ſcales which appear on the head of the crocodile; and beſides, the ſnout of the alligator is flatter, wider, and more rounded at the extremity. The ſize of the alligator is little inferior to that of the crocodile. Individuals have been often ſeen from 18 to 20 feet long.

Cateſby, in his hiſtory of Carolina, has given a fuller account of the economy and habits of the alligator, than any other author. "Though the largeſt, ſays he, and greateſt numbers of alligators, inhabit the torrid zone, the continent abounds with them 10° more north, particularly as far as the river Neus in North Carolina. In the latitude of about 33°, beyond which I have never heard of any, which latitude nearly anſwers to the northermoſt parts of Africa, where they are likewiſe found, they frequent not only ſalt rivers near

Lizards.

the ſea, but ſtreams of freſh water in the upper parts of the country, and in lakes of ſalt and freſh water; on the banks of which they lie lurking among reeds, to ſurpriſe cattle and other animals. In Jamaica, and many parts of the continent, they are found about 20 feet in length. They cannot be more terrible in their aſpect than they are formidable and miſchievous in their natures, ſparing neither man nor beaſt they can ſurpriſe, pulling them down under water; that being dead, they may with greater facility, and without ſtruggle or reſiſtance, devour them. As quadrupeds do not ſo often come in their way, they almoſt ſubſiſt on fiſh; but as providence, for the preſervation, or to prevent the extinction of defenceleſs creatures, hath in many inſtances reſtrained the devouring appetites of voracious animals by ſome impediment or other; ſo this deſtructive monſter, by the cloſe connection of his vertebræ, can neither ſwim nor run any way but ſtraight forward, and is conſequently diſabled from turning with that agility requiſite to catch his prey by purſuit; therefore, they do it by ſurpriſe in the water, as well as by land; for effecting which, nature ſeems in ſome meaſure to have recompenſed their want of agility, by giving them a power of deceiving and catching their prey by a ſagacity peculiar to them, as well as by the outer form and colour of their body, which on land reſembles an old dirty log or tree, and in the water frequently lies floating on the ſurface, and there has the like appearance; by which, and his ſilent artifice, fiſh, fowl, turtle, and all other animals are deceived, ſuddenly catched, and devoured.

Carnivorous animals get their food with more difficulty and leſs certainty than others; and are often neceſſitated to faſt a long time, which a ſlow concoction enables them to endure: reptiles particularly, by ſwallowing what they eat whole, digeſt ſlowly, eat ſeldom, and live long without food. Wolves are ſaid to gorge themſelves with mud, to ſupply the want of better food. For the like cauſe, many alligators ſwallow ſtones and other ſubſtances to diſtend and prevent the contraction of their inteſtines when empty, and not to help digeſtion, which they ſeem in no need of. For in the greater number of many which I have opened, nothing has appeared but lumps of light wood and pieces of pine-tree coal, ſome of which weighed eight pounds, and were reduced and worn ſo ſmooth from their firſt angular roughneſs, that they ſeemed to have remained in them many months. They lay a great number of eggs at one time on the ſandy banks of rivers and lakes, which are hatched by the heat of the ſun without further care of the parents. The young, as ſoon as they are diſengaged from their ſhells, betake themſelves to the water, and ſhift for themſelves; but while young, they ſerve as a prey not only to ravenous fiſh, but to their own ſpecies. It is to be admired, that ſo vaſt an animal ſhould at firſt be contained in an egg no better than that of a turkey.

In South Carolina they are very numerous; but the northern ſituation of that country occaſions their being of a ſmaller ſize than thoſe nearer the line; and they rarely attack men or cattle, yet are great devourers of hogs. In Carolina they lie torpid from about October to March in caverns and hollows in the banks of rivers; and at their coming out in the ſpring, make a hideous bellowing noiſe. The hind part of their belly and tail are eaten by the Indians. The fleſh is delicately white, but has ſo perfumed a taſte and ſmell, that I never could reliſh it with pleaſure. Lizards.

The alligators of South America, like the turtles, depoſit their eggs at two or three different periods, at the diſtance of ſeveral days, and from 20 to 24 eggs each time. They have been obſerved to raiſe a ſmall hillock near the banks of the river; and, after hollowing it out in the middle, to collect a quantity of leaves and other vegetable matters, in which they depoſit their eggs. Theſe are covered with the leaves, and are hatched by means of the heat extricated during their putrefaction, along with that of the atmoſphere. The alligators about Cayenne depoſit their eggs in the month of April."

To the account of the alligator which we have now given, we add the following particulars concerning its natural hiſtory by Don Ulloa, in his voyage to South America. The obſervations were made on the river Guayaquil; and we ſhall detail them in his own words.

"The increaſe of fiſh, ſays he, in this river is greatly hindered by the prodigious numbers of alligators, an amphibious creature, living both in the rivers and the adjacent plains, though it is not often known to go far from the banks of the river. When tired with fiſhing, they leave the water to baſk themſelves in the ſun, and then appear more like logs of half-rotten wood thrown aſhore by the current, than living creatures; but upon perceiving any veſſel near them, they immediately throw themſelves into the water. Some are of ſo monſtrous a ſize as to exceed five yards in length. During the time they lie baſking on the ſhore, they keep their huge mouths wide open, till filled with muſquetoes, flies, and other inſects, when they ſuddenly ſhut their jaws and ſwallow their prey. Whatever may have been written with regard to the fierceneſs and rapacity of this animal, I, and all our company know from experience, they avoid a man, and on the approach of any one, immediately plunge into the water. Its whole body is covered with ſcales impenetrable to a muſket ball, unleſs it happens to hit them in the belly near the fore legs, the only part vulnerable.

"The alligator is an oviparous creature. The female makes a large hole in the ſand near the brink of a river, and there depoſits her eggs, which are nearly equal to thoſe of an oſtrich, and as white as thoſe of a hen, but much more ſolid. She generally lays about a hundred, continuing in the ſame place till they are all depoſited, which is about a day or two. She then covers them with the ſand; and the better to conceal them, rolls herſelf not only over her precious depoſitum, but to a conſiderable diſtance. After this precaution ſhe returns to the water, till natural inſtinct informs her, that it is time to deliver her young from their confinement; when ſhe comes to the ſpot, followed by the male, and tearing up the ſand, begins breaking the eggs, but ſo carefully, that ſcarce a ſingle one is injured; and a whole ſwarm of little alligators are ſeen crawling about. The female then takes them on her neck and back in order to remove them into the water; but the watchful gallinazos make uſe of this opportunity to deprive her of ſome; and even the male alligator, which indeed comes for no other end, devours what he can, till the female has reached the water with the few remaining; for all thoſe which either fall from her

Lizards. back, or do not ſwim, ſhe herſelf eats; ſo that of ſuch a formidable brood, happily not more than four or five eſcape.

"The gallinazos mentioned in our account of Carthagena, are the moſt inveterate enemies of the alligators, or rather extremely fond of their eggs, in finding which they make uſe of uncommon addreſs. Theſe birds often make it their whole buſineſs to watch the females during the ſummer, the ſeaſon when they lay their eggs, the ſands on the ſides of the river not being then covered with water. The gallinazo perches in ſome tree, where it conceals itſelf among the branches, and there ſilently watches the female alligator till ſhe has laid her eggs and retires, pleaſed that ſhe has concealed them beyond diſcovery. But ſhe is no ſooner under the water, than the gallinazo darts down on the repoſitory, and with its beak, claws and wings, tears up the ſand, and devours the eggs, leaving only the ſhells. This banquet would indeed richly reward its long patience, did not a multitude of gallinazos, from all parts join the fortunate diſcoverer and ſhare in the ſpoil. I have often been entertained with this ſtratagem of the gallinazos, in paſſing from Guayaquil to the cuſtom-houſe of Babahoyo; and my curioſity once led me to take ſome of the eggs, which thoſe who frequent this river, particularly the mulattoes, make no difficulty of eating when freſh. Here we muſt remark the methods uſed by providence in diminiſhing the number of theſe deſtructive creatures, not only by the gallinazos, but even by the males themſelves. Indeed neither the river nor the neighbouring fields would otherwiſe be ſufficient to contain them; for, notwithſtanding the ravages of theſe two inſatiable enemies, their numbers can hardly be imagined.

"Theſe alligators are the great deſtroyers of the fiſh in this river, it being their moſt ſafe and general food; nor are they wanting in addreſs to ſatisfy their deſires, eight or ten, as it were by compact, draw up at the mouth of a river or creek, whilſt others of the ſame corps go a conſiderable diſtance up the river, and chaſe the fiſh downwards, by which none of any bigneſs eſcape them. The alligators, being unable to eat under water, on ſeizing a fiſh, raiſe their heads above the ſurface, and by degrees draw the fiſh from their jaws, and chew it for deglutition. After ſatisfying their appetite, they retire to reſt on the banks of the river

"When they cannot find fiſh to appeaſe their hunger, they betake themſelves to the meadows bordering on the banks of the river, and devour calves and colts; and in order to be more ſecure in ſeizing their prey, take the opportunity of the night, that they may ſurpriſe them in their ſleep; and it is obſerved that thoſe alligators which have once taſted fleſh, become ſo fond of it, as never to take up with fiſh but in caſes of neceſſity. There are even too many melancholy inſtances of their devouring the human ſpecies, eſpecially children, who, from the inattention natural to their age, have been without doors after it is dark; and though at no great diſtance, theſe voracious animals have dared to attack them, and having once ſeized them with their mouth, to make ſure of their prey againſt that aſſiſtance which the cries of the victim never fail to bring, haſten into the water, where they immediately drown it, and then return to the ſurface and devour it at leiſure. Lizards.

"Their voracity has alſo been felt by the boatmen, who, by inconſiderately ſleeping with one of their arms or legs hanging over the ſide of the boat, theſe animals have ſeized, and drawn the whole body into the water. Alligators who have once feaſted on human fleſh are known to be the moſt dangerous, and become, as it were, inflamed with an inſatiable deſire of repeating the ſame delicious repaſt. The inhabitants of thoſe places where they abound are very induſtrious in catching and deſtroying them. Their uſual method is by a caſonate, or piece of hard wood ſharpened at both ends, and baited with the lungs of ſome animal. This caſonate they faſten to a thong, the end of which is ſecured on the ſhore. The alligator, on ſeeing the lungs floating on the waters, ſnaps at the bait, and thus both points of wood enter his jaws in ſuch a manner, that he can neither ſhut nor open his mouth. He is then dragged aſhore, where he violently endeavours to reſcue himſelf, while the Indians bait him like a bull, knowing that the greateſt damage he can do is to throw down ſuch, as for want of care or agility do not keep out of his reach.

"The form of this animal ſo nearly reſembles that of the lagarto or lizard, that here they are commonly called by that name; but there is ſome difference in the ſhape of the head, which in this creature is long, and towards the extremity ſlender, gradually forming a ſnout, like that of a hog, and, when in the river, is generally above the ſurface of the water; a ſufficient demonſtration that the reſpiration of a purer air is neceſſary to it. The mandibles of this creature have each a row of very ſtrong and pointed teeth, to which ſome writers have attributed particular virtues; but all I can ſay to this is, that they are ſuch as I and my companions, notwithſtanding all our enquiries to attain a complete knowledge of every particular, could never hear any ſatisfactory account of *." * Vol. i. 200.

3. Lacerta Gangetica, *Gangetic* or *Indian Crocodile.*

Specif. Char.—Jaw ſomewhat cylindrical, elongated; tail furniſhed above with two creſts uniting in one towards the extremity.

In this ſpecies the jaws are long, narrow, and ſtraight; and the upper mandible is terminated above by an elevated tubercle. This ſtructure of the ſnout is more remarkable in the young animal. The teeth of this ſpecies are more numerous than in the common crocodile, being nearly double the number, and they are of equal ſize through the whole length of the jaws. Excepting that the third and fourth toes, both on the fore and hind feet are connected together by a web; the ſtructure of the feet is the ſame as that of the common one. The eyes are extremely prominent; and it has been obſerved, are ſo conſtructed, that they may be raiſed above the water, when the reſt of the body is under the ſurface; by which the animal is enabled to ſee its prey either on the ſurface of the water, or on the banks of rivers. In the general form and colour of the body and limbs, this ſpecies reſembles the common crocodile, only the number of tranſverſe bands formed by the rows of ſcales on the back, is greater.

It

Lizards. It is a native of India, and is chiefly found in the Ganges, where it is nearly equal in ſize to the common crocodile.

Sect. II. Guanas.

The animals belonging to this ſection have the back and tail ſerrated or carinated.

4. Lacerta Iguana, *Common* or *Great American Guana.*

Specif. Char.—Tail long and round; back ſerrated; gular creſt denticulated.

The guana, which of all the lizard tribe is of the moſt peculiar form, grows to a conſiderable ſize. It is often ſeen, three, four, and ſometimes five feet long. The general colour is green, ſhaded with brown. The back is ſtrongly ſerrated; which, as well as the denticulations of the pouch at the throat, gives it a formidable appearance.

The guana is a native of many parts of America, and the Weſt Indies. It is ſaid alſo that it has been found in ſome parts of the Eaſt Indies. It frequents rocky and woody places, and feeds chiefly on inſects and vegetables.

The guana itſelf is reckoned very nouriſhing and delicate food. The uſual method of taking it, is by caſting a nooſe over its head, and then drawing it from its place; for without making any attempt to eſcape, it ſtands with its eyes fixed ſtedfaſtly at its diſcoverer, while at the ſame time it inflates its throat to a very large ſize.

Cateſby has given a good account of the guana, which we ſhall detail in his own words. "They are," "he ſays," of various ſizes, from two to five feet in length; their mouths are furniſhed with exceeding ſmall teeth, but their jaw is armed with a long beak, with which they bite with great ſtrength. They inhabit warm countries only, and are rarely to be met with anywhere north or ſouth of the tropics. Many of the Bahama iſlands abound with them, where they neſtle in hollow rocks and trees. Their eggs have not a hard ſhell, like thoſe of alligators, but a ſkin only like thoſe of a turtle, and are eſteemed a good food. They lay a great number of eggs at a time in the earth, which are there hatched by the ſun's heat. Theſe guanas are a great part of the ſubſiſtence of the inhabitants of the Bahama iſlands, for which purpoſe they viſit many of the remote keys and iſlands in their ſloops to catch them, which they do by dogs trained up for that purpoſe, which are ſo dexterous as not often to kill them; which, if they do, they ſerve only for preſent ſpending; if otherwiſe, they ſew up their mouths to prevent their biting, and put them into the hold of their ſloop till they have catched a ſufficient number; which they either carry alive for ſale to Carolina, or ſalt and barrel up for the uſe of their families at home. Theſe guanas feed wholly on vegetables and fruit, particularly on a kind of fungus growing at the roots of trees, and on the fruits of the different kinds of anonas. Their fleſh is eaſy of digeſtion, delicate, and well taſted. They are ſometimes roaſted, but the more common way is to boil them, taking out the leaves of fat, which are melted and clarified, and put into a calabaſh or diſh, into which they dip the fleſh of the guana as they eat it. It is remarkable that this fat, which adheres to the inſide of abdomen, imbibes the colour of the fruit the animal eats laſt, which I have frequently ſeen tinged of a pale red, yellow, or ſometimes of a purple colour; which laſt was from eating the *prunus maritima*, which fruit at the ſame time I took out of them. Though they are not amphibious, they are ſaid to keep under water above an hour. When they ſwim, they uſe not their feet, but clap them cloſe to their body, and guide themſelves with their tails. They ſwallow all they eat whole; they cannot run faſt, their holes being a greater ſecurity to them than their heels. They are ſo impatient of cold, that they rarely appear out of their holes but when the ſun ſhines." Lizards.

Dr Brown, in his natural hiſtory of Jamaica, gives the following particulars of the guana. "Like moſt of the tribe, he obſerves, it lives a very conſiderable time without food, and changes its colour with the weather, or the native moiſture of its place of reſidence. I have kept a grown guana about the houſe for more than two months: it was very fierce and ill-natured at the beginning; but after ſome days it grew more tame, and would, at length, paſs the greateſt part of the day upon the bed or couch, but it went out always at night. I have never obſerved it to eat any thing, except what imperceptible particles it had lapped up in the air; for it frequently threw out its forked tongue, like the chamelion, as it walked along. The fleſh of this creature is liked by many people, and frequently ſerved up in fricaſees at their tables; in which ſtate they are often preferred to the beſt fowls. The guana may be eaſily tamed while young, and is both an innocent and beautiful creature in that ſtate."

Var. Horned guana. This is conſidered as a variety of the former. It is nearly the ſame in ſize and general proportion; the back is alſo ſerrated, and the form of the ſcales is the ſame. It wants, however, the gular pouch, and there are in front of the head, between the eyes and noſtrils, four pretty large ſcaly tubercles, behind which there is a bony conical proceſs, which is covered with a ſingle ſcale.

It is a native of St Domingo, where it is ſaid to be very common.

5. Lacerta Amboinensis, *Amboina Guana.*

Specif. Char. Variegated, tail long, tail fin radiated, dorſal future dentated.

This ſpecies, which grows to the length of three feet, and ſometimes more, is at once diſtinguiſhed by the ſingularity of its appearance, and the beauty of its colours. The head and neck are green, and variegated with white tranſverſe undulations. The back and tail are brown, with a ſhade of purple. The ſides and belly are grayiſh, or pale brown; the head is tuberculated above, and covered with ſmall roundiſh ſcales; the mouth is wide, and the teeth are ſharp and numerous.

This ſpecies is a native of the Eaſt Indies, but is moſt frequent in the iſland of Amboina, frequenting the neighbourhood of rivers and other freſh waters. It is often ſeen on the banks of riſing grounds, and on low ſhrubs which grow near the water. It does not aſcend tall trees. Whenever it is diſturbed by the approach

Lizards.

proach of men or any animal, it plunges into the water, and conceals itſelf beneath the rocks or ſtones under the banks. It may be eaſily taken, as it does not attempt to bite or defend itſelf, but ſeems in ſome meaſure ſtupified.

This ſpecies, like others of the tribe, depoſits its eggs in the ſand, on the banks of the rivers which it frequents. The eggs in the body of the animal are diſpoſed in two long groups or cluſters, and are of a yellow colour; but when they are excluded, they are white, and of an oblong ſhape. The Amboina guana is reckoned a more delicate food than the common one; its fleſh is ſaid to be white, ſweet, and of a penetrating odour.

6. Lacerta Basiliscus, *Baſiliſk.*

Specif. Char.—Tail long; dorſal and caudal fins radiated; occipital creſt pointed.

The baſiliſk is about one foot and a half in length, of a pale aſh-brown colour, with ſome darker variegations about the upper part of the body. In the young animal, the dorſal or caudal proceſs, and the pointed occipital creſt mentioned in the ſpecific deſcription, are leſs diſtinct.

The baſiliſk is chiefly a native of South America. It reſides principally among trees, and feeds on inſects.

It is ſaid to be a very active animal, and by means of its dorſal creſt or fin, it is enabled to ſpring from tree to tree. It can alſo ſwim with great eaſe.

This animal has a very formidable appearance, but is quite harmleſs; but in the poetical deſcriptions of the ancients, we find that it was conſidered to be the moſt malignant of all poiſonous animals; even its look was regarded as fatal. The terrific glance of the baſiliſk in the African deſerts, according to the poetical repreſentation of Lucan, obliged the reſt of the poiſonous tribe to keep at a diſtance.

7. Lacerta Calotes, *Galeot Lizard.*

Specif. Char.—Tail long and round; back dentated on the fore part, and the head on the hind part.

This ſpecies ſeldom exceeds a foot and a half in length, from the tip of the noſe to the extremity of the tail; but otherwiſe in its general habit and appearance, it reſembles the common guana. It wants, however, the gular pouch; in its place there is only a ſlight enlargement of the throat. The colour, which occaſionally varies, is moſt commonly of an elegant bright blue, variegated with broad, irregular, white, tranſverſe bands on each ſide of the body and tail. The limbs are ſlender, and this is particularly the caſe with the toes.

This ſpecies is a native of the warmer regions of Africa, Aſia, and many of the Indian iſlands. It is very common in Ceylon. It is ſaid alſo to be a native of Spain, where it wanders about the tops of houſes, in ſearch of ſpiders. According to ſome, it preys on rats, and, like ſome other lizards, attacks ſmall ſerpents.

8. Lacerta Agama, *American Galeot.*

Specif. Char.—Tail long, round; neck above, and head behind, aculeated; ſcales of the hind head reverſed.

This ſpecies in ſome reſpects reſembles the calotes; but it wants the ſtrong ſerratures on the back, in place of which it has only a ſmall denticulated carina. The head is proportionally larger, and on the back part is furniſhed with ſharp-pointed ſcales, ſome of which are reverſed at their extremities. The colour is brownish, and variouſly clouded. In the male, the creſt on the back is compoſed of longer ſpines, and extends to the lower part.

Lizards.

It is a native of South America, and ſome of the iſlands of the Weſt Indies.

Var. *Lacerta Muricata*, Muricated Lizard. Tail long, round; body grayiſh; ſcales carinated and ſharp-pointed.

This lizard, which is conſidered as a variety of the preceding, meaſures more than a foot in length, and has even been ſometimes found to exceed that ſize. The want of the reverſe ſcales on the back part of the head, conſtitutes the principal difference between this and the former ſpecies.

It is a native of New South Wales.

9. Lacerta Bicarinata, *Bicarinated Lizard.*

Specif. Char.—Tail of moderate length; four rows of ſtrong carinated ſcales on the back.

In its general habit, this ſpecies bears ſome reſemblance to a ſmall crocodile, on account of the hard tuberculated and carinated ſcales on the upper parts of the body, two rows of which are more prominent than the reſt, and extend from the upper part of the back to the tail, where they coaleſce and form a ſerrated creſt to the extremity.

The head is ſmall, the mouth wide, and the ſnout ſomewhat ſharp. The colour is reddiſh-brown, tinged in ſome parts with various ſhades of green.

It is a native of South America, where it is ſometimes uſed as food. The eggs, it is ſaid, are alſo greatly eſteemed for the ſame purpoſe. Woody and marſhy regions are the uſual places of its reſort. One of this ſpecies which was kept alive for ſome time by M. de la Borde, was obſerved to remain for hours together in the water, and when it was diſturbed or alarmed, it concealed itſelf, but delighted to come out occaſionally and baſk in the ſun.

Var. A lizard known by the name of *iguaruca*, and ſaid to be a native of Brazil, is conſidered as a variety of the preceding, differing only in the colour, which is darker, and the claws which are ſhorter; but, like it, it has ſome reſemblance to the crocodile, and readily climbs trees.

10. Lacerta Monitor, *Monitory Lizard.*

Specif. Char.—Colour black; tail very long, compreſſed, carinated; body marked with tranſverſe rows of white, ocellated.

This is one of the largeſt of the whole tribe of lizards. From the tip of the noſe to the extremity of the tail, it ſometimes meaſures no leſs than four or five feet. It is alſo one of the moſt beautiful. The head is ſmall, the ſnout gradually tapers, the limbs are ſlender, and the tail which is laterally compreſſed, gradually decreaſes towards the extremity. Indeed the ſhape altogether is ſlender and elegant, and although the colours are ſimple, they

Lizards. they are so disposed as to produce an agreeable and pleasing effect. This species is a native of South America, inhabiting woody and marshy places.

It is said that the monitory lizard from the gentleness of its disposition, is remarkable for its attachment to mankind, warning them of their danger from the alligator by emitting a peculiar and shrill sound.

Var. *Lacerta Varia*, Variegated Lizard.—Although this lizard is somewhat different in colour, and in the disposition of its variegations, which are rather of a pale yellow than white, yet it is considered only as a variety of the preceding. It is a native of New Holland.

11. Lacerta Acanthura, *Spine-tailed Lizard.*

Specif. Char.—Throat plaited beneath; body covered with minute scales; tail long and verticillated with carinated triple-spined scales.

The length of this species is about a foot and a half. The head is covered with scales, which are small and nearly six-sided; it is quite distinct from the body. The whole skin about the neck, throat, and beginning of the sides, is quite loose, which in the specimen described, may have had a pouched appearance. All the other parts of the body are covered with very small scales. The tail is very long, and strongly marked into numerous rings, which are composed of long and strongly carinated scales, each of which terminates in a lengthened point, and produces the spiny appearance. There are five long toes on each foot; the claws are strong and sharp. The colour on the upper parts of the body is glaucous, variegated with small whitish clouds and marblings.

It is described by Dr Shaw from a specimen in the British Museum.

12. Lacerta Lophura, *Sharp-tailed Lizard.*

Specif. Char.—Body covered with dissimilar scales; back serrated; tail long, and somewhat compressed.

This is a very large species; there are large, rounded, and oval scales scattered here and there among the smaller ones. The tail is long and sharp-pointed; the back and tail are serrated throughout their whole length.

This species is also described by Dr Shaw from a specimen in the British Museum.

13. Lacerta Dracæna, *Dracæna Lizard.*

Specif. Char.—Large tail; long and denticulated along the upper part.

This is one of the largest species belonging to the tribe. Not only in the size of the body, but in the proportion of the limbs and tail, it exceeds that of the guana. The colour is brown, with a slight shade of chesnut. On the out sides of the limbs there are numerous small pale yellowish spots. The head is small, and the snout tapering.

It is a native of South America, and some of the Indian islands; and it is said that in some countries it is preferred as an article of food to the guana.

14. Lacerta Superciliosa, *Supercilious Lizard.*

Specif. Char.—Tail carinated; back and eyebrows ciliated, with upright lanceolated scales.

The general appearance of this species bears some resemblance to the guana, and still more to the horned guana, in having the appearance of a pair of sharp pointed horn-like processes above and beyond each eye; between these are placed some aculeated scales. The size of one which has been described, measures from 12 to 16 inches, from the tip of the nose to the extremity of the tail. Lizards.

It is a native of Asia, and of some of the Indian islands.

15. Lacerta Scutata, *Scutated Lizard.*

Specif. Char.—Tail of moderate length, compressed; dorsal suture dentated; two pointed processes on the back of the head.

This species is distinguished from the former by having a proportionally larger head, and a row of scales more elevated than the rest, passing over each eye; and from these a ridge is continued towards the back of the head, where they unite and extend down the middle of the back, in form of a short denticulated crest, to the beginning of the tail. The body is covered with acuminated scales which are but small; the limbs and tail with larger ones.

It is a native of the island of Ceylon.

16. Lacerta Principalis, *Smooth Crested Lizard.*

Specif. Char.—Tail subcarinated; gular crest plain edge; back smooth.

This species is in general of a slender form, and small, rarely exceeding eight or nine inches in length, including both the body and tail. The colour is blue, the head small, and the snout taper.

It is a native of South America.

Var. *Lacerta bimaculata*, Linn.

This is considered as a variety of the former; the colour is blue, spotted here and there with black, with two larger black spots over the shoulders.

It is a native of St Eustatia, and is found also in Pennsylvania.

Var. Le Roquet, of Cepede, is considered by Dr Shaw also as a variety of the smooth-crested lizard, as it resembles it both in size and habit; it is however destitute of the gular crest.

It frequents gardens, moving nimbly among trees, and devours great multitudes of smaller insects.

17. Lacerta Strumosa, *Strumous Lizard.*

Specif. Char.—Tail long, round; breast gibbose, projecting.

This is of a small size, has no dorsal serratures, but is furnished with a large flat gular crest, of a pale red colour; the rest of the animal is of a pale bluish gray, with some slight shades of a more dusky hue. The limbs are slender.

It is a native of South America.

18. Lacerta Marmorata, *Marbled Lizard.*

Specif. Char.—Tail long, round; throat subcrestated, back smooth.

This species is of a slender and elegant form, and measures, including the tail, about a foot in length. The

The head is ſmall, the ſnout taper. The colour is pale blue, variegated with undulating tranſverſe bands of a whitiſh ſhade. The belly is of a pale roſe colour.

It is a native of America and the Weſt Indies.

19. Lacerta Umbra, *Umber Lizard.*

Specif. Char.—Tail long, round; neck ſubcreſtated above; hind head callous; back ſtriated.

This is a ſmall ſpecies; the body is covered with ſcales, which are carinated and pointed; the head is obtuſe, and marked on the hind part with a large callous bare ſpot.

It is a native of North America.

Sect. III. Cordyles.

Having denticulated or ſpiny ſcales on the body or tail, or both.

20. Lacerta Pelluma, *Pelluma Lizard.*

Specif. Char.—Tail long, and verticillated with rhomboidal ſcales.

This lizard is about two feet in its total length, and is diſtinguiſhed on the upper parts of its body by a beautiful variety of green, yellow, blue, and black colours. The under parts of the body are of a gloſſy yellowiſh green.

It is a native of Chili.

21. Lacerta Azurea, *Azure Lizard.*

Specif. Char.—Tail ſhort, verticillated with mucronated ſcales.

This is of a fine blue colour, tranſverſely banded with black or blue. It is ſometimes only a few inches long, but others are found of a larger ſize.

The larger variety is a native of South America, the ſmaller of ſome parts of Africa.

22. Lacerta Cordylus, *Cordyle Lizard.*

Specif. Char.—Body ſmooth; tail ſhort and verticillated with denticulated ſcales.

This ſpecies, at firſt ſight, bears a conſiderable reſemblance to the former; but the ſcales which cover the body are of an oblong-ſquare form, and larger, and the tail is verticillated with rows of large ſcales of the ſame form. The colour is ſometimes blue, ſometimes a livid brown, and the total length is about ten inches.

23. Lacerta Stellio, *Rough Lizard.*

Specif. Char.—Tail verticillated, with denticulated ſcales; body and head muricated.

The whole upper ſurface of the body is remarkably rough, from being covered with projecting pointed ſcales. It is of a pale bluiſh brown colour, with ſome deeper and lighter tranſverſe variegations. It is about eight inches long.

This ſpecies is a native of many parts of Africa.

24. Lacerta Angulata, *Angulated Lizard.*

Specif. Char.—Tail long, hexagonal, and furniſhed with carinated and mucronated ſcales.

This is a ſmall ſpecies of a brown colour. Beneath the throat there are two large rounded ſcales. The tail is longer than the body, and ſtrongly marked with ſix longitudinal ridges.

It is a native of America.

25. Lacerta Orbicularis, *Orbicular Lizard.*

Specif. Char.—Body brown, round; tail ſhort, round; ſcales muricated.

The colour of this ſpecies is duſky brown, variegated with different ſhades; the body is large and ventricoſe, and in this reſpect it reſembles the toad.

This is a native of South America, but is a rare ſpecies.

Sect. IV. Lizards Proper.

The ſurface of the body is ſmooth, and they are generally furniſhed with broad ſquare plates or ſcales on the abdomen.

26. Lacerta Agilis, *Green Lizard.*

Specif. Char.—Of a green colour, with minute duſky variegations. There is a collar of large ſcales beneath the neck; tail long, verticillated.

The length of this ſpecies is from 10 to 15 inches; but it ſometimes arrives at ſuch a ſize as to meaſure more than two feet to the end of the tail. The colour conſiſts of a mixture of different ſhades of green, with ſpots of yellow, brown, black, and ſometimes red. The head is covered with angular ſcales, and the reſt of the upper parts of the body with ſmall ovate ones. The tail is longer than the body, and is marked with numerous rings of oblong ſquare ſcales.

This ſpecies is a native of all the warmer parts of Europe. It is found in gardens about warm walls, buildings, &c. It is a very active animal, and purſues its prey, which conſiſts of inſects, with great celerity. When it is caught, it ſoon becomes familiar, and may even in ſome meaſure be tamed.

Var. The gray lizard, or little brown lizard, which is alſo a native of many parts of Europe, is conſidered as a variety of the former. It is about ſix or eight inches long, of a greeniſh brown, or pale grayiſh colour.

This variety is a native of Britain, and is found on the ſides of dry banks, or ſand hills, where it is occaſionally ſeen baſking during the heat of ſummer. It is alſo found about the roots of trees, old walls, &c.

27. Lacerta Teguixin, *Variegated Lizard.*

Specif. Char.—Tail long, round; ſides ſomewhat wrinkled; plate under the throat triple.

This ſpecies is ſometimes larger than the guana. The head is covered with large ſcales or plates, and the body with ſmaller and ſquare ſcales. The colour is extremely beautiful; it conſiſts of an elegant variega-

tion of black, brown, and purple ſpots, on a pale bluiſh, white, and yellowiſh ground.

It is a native of South America.

28. Lacerta Erythrocephala, *Red-headed Lizard.*

Specif. Char.—Colour blackiſh green, undulations tranſverſe and black; abdomen longitudinally banded with black, white, and blue; breaſt black; top of the head red.

This ſpecies is of a moderate ſize; the ſcales on the head are largeſt, and there is a row of tubercles beneath the thighs.

It is a native of the iſland of St Chriſtopher.

29. Lacerta Cerulea, *Ameiva Lizard.*

Specif. Char.—Colour blue, with black and white variegations; tail long, verticillated; abdominal ſcuta 30.

The ameiva greatly reſembles the green lizard, but it wants the ſcaly collar. The ſcales on the upper part of the body are not diſtinctly viſible; thoſe of the abdomen are compoſed of ſquare plates, and there is a row of tubercles beneath each thigh.

It is a native of South America, and it is ſaid that it is ſometimes found in Africa and Aſia.

30. Lacerta Lemniscata, *Striped Lizard.*

Specif. Char.—Colour duſky blue; eight white lines down the back; limbs ſpotted with white; tail long, round.

This is of a ſmaller ſize than the laſt ſpecies, but in its general appearance bears a conſiderable reſemblance. The white ſtripes on the back vary in breadth, and ſometimes in number.

It is a native of Guinea, but is alſo found in ſome parts of India and South America.

31. Lacerta Quadrilineata, *Four-ſtriped Lizard.*

Specif. Char.—Colour blackiſh blue; four white or yellowiſh lines down the back; tail long, round; fore feet tetradactylous.

This is a ſmaller ſpecies than the laſt, but reſembles it greatly. The claws are very ſmall.

It is ſuppoſed to be a native of North America.

32. Lacerta Teniolata, *Ribband Lizard.*

Specif. Char.—Body marked above with black and white ſtripes; beneath white; tail long and round.

This is a ſmall ſpecies; the colour above is cheſnut brown, and the ſcales on every part of the body are ſmooth, round, and imbricated. From the head to the middle of the tail there are ſix white linear ſtripes. The limbs are ſtriped longitudinally with black.

It is a native of New Holland.

33. Lacerta Sexlineata, *Six-lined Lizard.*

Specif. Char.—Colour gray brown; ſix white lines down the back; tail long, verticillated.

This is a ſmall ſpecies. Beneath the throat there is a double plate, and a row of tubercles beneath the thighs. The legs are long and the feet ſlender; the tail is carried curved over the back, from which it has been called the lion lizard.

It is a native of the Weſt Indies, where it frequents the rocks on the ſea coaſt.

34. Lacerta Fasciata, *Faſciated Lizard.*

Specif. Char.—Colour of the body brown; tail blue and rather long. There are five yellowiſh lines down the back.

This is a ſmall ſpecies, rarely exceeding eight inches in its whole length. The head is ſhort.

It is a native of Carolina, inhabiting hollow trees.

35. Lacerta Quinquelineata, *Five-lined Lizard.*

Specif. Char.—Colour duſky; five whitiſh lines down the back; tail round, and of a moderate length.

This is a ſmall ſpecies. The tail is twice the length of the body. There are ſix ſtripes on the head. The abdomen is imbricated with ſtriæ.

It is a native of Carolina.

36. Lacerta Interpunctata, *Punctated Lizard.*

Specif. Char.—Tail long, round; dorſal lines two, and yellow, having black ſpecks interſperſed.

This is a ſmall ſpecies; the body is ſmooth and gloſſy, and the head is covered with large ſcales.

It is a native of Aſia.

37. Lacerta Bullaris, *Red-throated Lizard.*

Specif. Char.—Colour green; gular pouch red; tail long, round.

This ſpecies is about ſix inches long, of a ſhining graſs-green colour. When it is approached, the throat ſwells into a globular form, and the protruded ſkin becomes of a bright red colour. This is ſuppoſed to be a threatening aſpect, but probably without foundation.

This ſpecies is a native of Jamaica, where it is common about hedges and trees.

Var. Green Carolina lizard.—This reſembles the former in every reſpect, except in the appearance of the gular pouch. In dry hot weather it appears of a bright green colour; but in cold weather this changes to a brown.

It is a native of Carolina, where it is very common about houſes.

38. Lacerta Cruenta, *Red-tailed Lizard.*

Specif. Char.—Colour brown; on the neck there are ſeven white ſtripes, and four on the back. Under the throat there is a plate; the tail is verticillated and red beneath.

This is a very ſmall ſpecies, reſembling the *lacerta velox*, but differs from it in having a ſharper ſnout. The limbs are marked with white round ſpots; the tail is red beneath and white at the tip. There is a row of tubercles on the thighs.

It is a native of the ſouthern parts of Siberia, and is found about the ſalt lakes.

39.

39. Lacerta Lobata, *Lobe-cheeked Lizard. Lacerta Aurata*, Linn.

Specif. Char.—Colour browniſh, with a roundiſh denticulated lobe on each ſide of the neck.

This ſpecies is of moderate ſize, and in appearance is ſomewhat thick or ventricoſe. Body rather depreſſed; the head rounded on each ſide. From the corner of the mouth extending to the ſhoulders, there is a flat ſemiorbicular lobe of a red colour, with ſerrated edges. The whole of the body is rough, with ſmall pointed granules.

It is a native of the ſouthern deſerts of Siberia, and is found among the ſand hills.

40. Lacerta Helioscopa, *Sun-gazing Lizard.*

Specif. Char.—Colour browniſh; head rough, with calli; a tranſverſe plate beneath the throat; tail imbricated, thick at the baſe, and ſharp at the tip.

This is a ſmall ſpecies, ſcarcely exceeding a finger's length. The colour of the upper parts of the body is gray, with brown and bluiſh ſpots and linear ſtreaks. The neck is often marked above with a red ſpot. The tip of the tail is red beneath.

It is a native of the ſouthern parts of Siberia, where it baſks in ſunny ſituations, with its head turned up towards the ſun.

41. Lacerta Turcica, *Turkiſh Lizard.*

Specif. Char.—Colour brown; body roughiſh; tail of moderate length, and ſomewhat verticillated.

This is a ſmall ſpecies; the head is rather large, and the body thickiſh; the tail ſhort, thick at the baſe, and pointed at the tip.

It is a native of eaſtern countries.

42. Lacerta Platura, *Broad-tailed Lizard.*

Specif. Char.—Colour gray brown, paler beneath; body rough; tail depreſſed, lanceolated, and ſpiny on the margin.

This ſpecies is from four to ſix inches long, and is remarkably diſtinguiſhed by the ſingular form of its tail. The feet are pentadactylous; the toes ſlender, and the claws curved.

It is a native of New Holland.

43. Lacerta Plica, *Plica Lizard.*

Specif. Char.—Hind head callous; eyebrows excoriated above; neck plated beneath, and warted at the ſides; tail long and round.

This is a ſmall ſpecies, not exceeding a finger's length. It is entirely covered with conical ſcales; there is a double plate beneath the throat.

It is a native of South America and India.

44. Lacerta Japonica, *Japaneſe Lizard.*

Specif. Char.—Tail long, round; feet unguiculated; fore feet tetradactylous; a ſingle ſtripe on the back.

This is a ſmall ſpecies; the colour above is livid brown, and the yellow ſtripe from the hind head to the beginning of the tail is broad and dentated. The claws are black.

45. Lacerta Nilotica, *Nilotic Lizard.*

Specif. Char.—Tail long and triquetrous; body ſmooth, with four lines of ſcales down the back.

This likewiſe is a ſmall ſpecies.

It is a native of Egypt.

46. Lacerta Tiliguerta, *Tiliguerta Lizard.*

Specif. Char.—Tail verticillated, twice the length of the body, and having eighty abdominal ſcuta.

This, like the former, is a ſmall ſpecies, meaſuring not more than ſeven or eight inches long. The female is of a brown, and the male of a green, colour, with black ſpots. It ſeems to bear ſome relation to the green lizard.

It is a native of Sardinia, where it is to be met with in fields, about walls, &c.

47. Lacerta Deserti, *Deſert Lizard.*

Specif. Char.—Tail round, longiſh; feet pentadactylous; body black above, and marked with ſix longitudinal white lines.

This is a very ſmall ſpecies; the body is white beneath, and the ſtripes on the back are compoſed of oblong ſpots.

It is a native of the Uralian deſert.

48. Lacerta Arguta, *Argute Lizard.*

Specif. Char.—Tail ſhort, verticillated; thick at the baſe and filiform at the tip; collar marked with obſcure ſcales. There is a remarkable double plate under the neck.

This ſpecies is ſomewhat ſimilar to the green lizard, but is ſhorter and more ventricoſe, and has a ſharper ſnout.

It is a native of the ſouth of Siberia.

49. Lacerta Algira, *Algerine Lizard.*

Specif. Char.—Tail long, verticillated; two yellow lines on each ſide of the body.

This ſpecies is about a finger's length, brown above, and yellowiſh beneath.

It is a native of Algiers.

50. Lacerta Velox, *Swift Lizard.*

Specif. Char.—Tail longiſh, verticillated; ſcaly collar beneath the neck; body cinereous, with five longitudinal paler bands, variegated with black ſpecks; the ſides ſpotted with black, and ſpeckled with blue.

This ſpecies is much ſmaller and more ſlender, but in other reſpects comes very near to the *lacerta agilis*. The hind feet are marked with orbicular ſpots.

It is a native of Siberia.

51. Lacerta Uralensis, *Ural Lizard.*

Specif. Char.—The tail is long and round; the neck plated

plated beneath; the feet are pentadactylous, and the back is livid, rugoſe, and ſubverrucoſe.

The length of this animal is about four inches; the head is roundiſh; the colour of the upper parts is livid brown, and the ſkin is wrinkled and ſlightly tuberculated.

It is a native of the deſert of Ural, and moves about with great ſwiftneſs.

52. Lacerta Seps, *Seps Lizard.*

Specif. Char.—Colour bluiſh brown; tail longiſh, verticillated; lateral future reflexed; ſcales ſquare.

This is a ſmall ſpecies, and is eaſily known from the thin lengthened form of its body, and long ſlender tail, as well as from the ſquare ſcales with which it is entirely covered. The tail is marked with about 50 diviſions.

It is a native of the ſouthern parts of Europe.

Sect. V. Chameleons.

Theſe are diſtinguiſhed by having a granulated ſkin, a large head, a long miſſile tongue and cylindrical tail.

53. Lacerta Chamæleon, *Common Chameleon.*

Specif. Char.—Crown flat; tail cylindrical and incurvated; toes united by two and three.

The length of the chameleon, from the tip of the noſe to the beginning of the tail, is about ten inches. The tail is nearly of the ſame length. The ſkin on every part of the animal is granulated. A ſeries of obſcure denticulations runs down the back, and forms a ridge on that part. There are five toes on each foot, two and three of which are united by a common ſkin, as far as the claws; the two outward and three inward toes of the fore feet are united, and the two inward and three outward of the hind feet. The ſtructure of the tongue of the chameleon is very peculiar; it is very long, and furniſhed with a dilated ſomewhat tubular tip, by which means it is enabled eaſily to ſeize inſects, which are its prey, by darting it out and ſecuring them on the tip.

The chameleon, like others of the amphibia, has the power of inflating its lungs, and retaining the air for a long time. It is in this way that it ſometimes appears plump and fleſhy, while at other times, when the air is ejected, and the lungs in a collapſed ſtate, it exhibits nothing but ſkin and bone. The natural colour of the ſkin of the chameleon is of a bluiſh aſh, and the uſual changes are from this to a green or yellowiſh colour, ſpotted unequally with red. When the animal is expoſed to full ſunſhine, the darkened ſide appears in a few minutes of a pale yellow, with large roundiſh ſpots of red brown; but when the animal is turned round, the reverſe takes place. The ſide formerly in the ſhade appears of a brown or aſh colour, and the other ſide yellow and red. Theſe changes, however, vary greatly, both with regard to the diſpoſition of the ſpots and the intenſity of the colours.

The chameleon is a native of Europe, Africa, and Aſia. It is indeed chiefly found in tropical regions; but it is alſo ſometimes met with in the warmer parts of Spain and Portugal.

No animal has been more celebrated than the chameleon, and particularly on account of the power which it was ſuppoſed to poſſeſs of changing its colour. This account was greatly exaggerated when it was aſſerted, that it could produce this change at pleaſure, and aſſimilate it to that of any particular object. But the more accurate obſervations of modern naturaliſts have ſhewn, that this change of colour varies greatly, and ſeems to depend on the ſtate of the animal's health, the temperature of the weather, and probably ſome other unknown cauſes. Another erroneous aſſertion with regard to the chameleon was, that it could live entirely on air. This no doubt aroſe from the long abſtinence which this animal, as well as many others belonging the claſs *amphibia*, can endure.

54. Lacerta Africana, *African Chameleon.*

Specif. Char.—Colour blackiſh; crown carinated.

This is one of the largeſt yet diſcovered. Along the back to the end of the tail there runs a pure white ſtripe, bounded by a broad blackiſh band. The other parts of the animal are variegated with pale aſh-coloured undulations.

It is ſuppoſed to be a native of Barbary.

55. Lacerta Pumila, *Little Chameleon.*

Specif. Char.—Body bluiſh on each ſide, and marked with two yellowiſh lines.

The head of this ſpecies is ſomewhat flatter than the former, but ſtill elevated in the middle, and edged on each ſide with a denticulated margin.

By ſome the two latter ſeem to be conſidered only as varieties.

Sect. VI. Geckos.

In the animals of this diviſion the ſkin is granulated or tuberculated; the feet are lobated, and the toes lamellated beneath.

56. Lacerta Gecko, *Common Gecko.*

Specif. Char.—Livid, with brown variegations; upper part of the body warted, and the lamellæ of the feet not divided.

This animal is ſaid to have received the name of *gecko* from the peculiar ſound of its voice, which bears ſome reſemblance to that word when uttered in a ſhrill tone. Its length, in general, is about a foot or more, and therefore it ranks among the middle-ſized animals of the lizard tribe. Its form is thicker and ſtronger than the greater part of lizards. Its head is flattiſh, ſomewhat triangular and large, with a covering of minute ſcales; its mouth is wide, eyes large, teeth ſmall, and its tongue is broad and flat. The limbs of this animal are moderately long, with broader feet than the reſt of the tribe; the toes are dilated on the margins, and beneath are divided into a number of tranſverſe lamellæ parallel to each other, without any longitudinal furrow. The general colour of the gecko is a pale brown.

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brown, with ſome irregular duſky or bluiſh variegations; but this colour becomes much more brilliant in warmer regions.

It is a native of Aſia and Africa, and ſome of the warmer parts of Europe, inhabiting obſcure receſſes, caverns, old walls, &c. It has been ſuppoſed to be of a poiſonous nature. A fluid exſudes from the lamellæ of the feet, which is ſaid to be extremely acrid; and when any of it has remained on fruit, when it is eaten, it is ſaid that it produces troubleſome ſymptoms. The peculiar ſtructure of the feet enables the animal to attach itſelf to the ſmootheſt ſurfaces.

Var. *Tokai.*—This, which is conſidered as a variety of the former, is about a foot long. The body is covered above with a granulated ſkin, varied with red and blue undulations; the belly is aſh colour, and interſperſed with red ſpots; the head is large and triangular.

This is a native of Siam, where it occaſionally enters the houſes, and is conſidered as a poiſonous animal.

The Indian ſalamander, deſcribed by Bontius, ſeems to be of the ſame kind; the length is about a foot; the colour ſea-green, ſpotted with red; the head large, and like that of a toad; the body is broad and the tail long.

It is a native of Java. It is ſaid that the inhabitants hold up the animal by the tail to make it diſcharge ſaliva from its mouth, which is collected for the purpoſe of poiſoning their arrows.

57. Lacerta Dubia, *Geckotte.*

Specif. Char.—Livid colour; upper ſurface covered with pointed warts; no femoral papillæ.

This ſpecies bears ſome reſemblance to the gecko; but differs from it in being thicker and ſhorter, and in wanting the papillæ under the thighs. The tail in the young animal is divided into ſtrongly marked aculeated rings. Theſe become gradually leſs conſpicuous with the age of the animal, and are at laſt totally obliterated.

It is a native of the ſouth of France, where it is known by the name of *tarente*, and is regarded as an innocent animal. It frequents ruins, walls, houſes; delights greatly in ſunſhine, and avoids damp ſhady ſituations. It remains concealed in the hollows of walls during winter, not, however, in a torpid, but in an inert ſtate.

58. Lacerta Perfoliata, *Perfoliated Gecko.*

Specif. Char.—Colour browniſh, ſmooth above; lamellæ of the feet divided by a furrow; tail frequently turbinated.

This ſpecies is of a thicker form, has ſhorter limbs, and the tubercles on the back are leſs diſtinct than the common gecko. It is alſo different in wanting the papillæ under the thighs. The tail is remarkably ſwelled immediately beyond its origin, and then tapers to the extremity, ſomewhat reſembling a young turnip root, from whence it has been denominated *lacerta rapicauda.*

Its native country is not mentioned.

59. Lacerta Mauritanica, *Mauritanic Gecko.*

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Specif. Char.—Colour brown, covered above with ſharp warts; tail flat, and furniſhed with ſcuta beneath; lamellæ of the feet lunulated and divided.

This ſpecies reſembles the common one, but is different from being covered with ſpiny or ſharp-pointed warts on the upper ſurface. The toes are lamellated beneath, but are not divided by a middle ſulcus.

60. Lacerta Sinensis, *Chineſe Gecko.*

Specif. Char.—Tail flat, all the toes unguiculated; face perforated with ſeveral pores.

The head is broad and flat; the teeth ſmall; the tongue flat, and emarginated at the tip. About the ſides of the noſe and eyes there are ſeveral ſcattered pores.

It is a native of China, and is frequently ſeen in houſes, running about the walls, and climbing readily on the ſmootheſt ſurfaces. It preys chiefly on the ſmaller kind of cock-roach. It is conſidered as an innocent animal.

61. Lacerta Vittata, *White-ſtriped Gecko.*

Specif. Char.—Colour yelloviſh brown, with a white dorſal band, which is forked over the head.

This is a ſmall ſpecies, not exceeding ſeven or eight inches in length; the head is large in proportion to the body; the toes are lamellated beneath, divided by a ſulcus, and terminated by curved claws. The upper ſurface is covered with extremely ſmall tubercles: they are ſo minute as to be ſcarcely perceptible.

This ſpecies is ſaid to be a native of India.

62. Lacerta Fimbriata, *Fimbriated Gecko.*

Specif. Char.—A membranaceous fimbriated border on each ſide of the body; tail flat; lamellæ of the feet divided by a furrow.

This is a very remarkable ſpecies, which, as the count de Cepede, who deſcribes it, obſerves, ſeems in ſome degree to connect the chameleon, the gecko, and the water-newts. The largeſt individual which he examined meaſured about eight inches and a half in length. The head is large and flattened, and its outline ſeen from above is nearly triangular, as in the chameleon; but the triangle is of a longer form, and there is no riſing creſt. The moſt remarkable part of its ſtructure is the fringed proceſs which commences on each ſide of the head, and is continued along the ſides of the body. The colour of this animal varies as in the chameleon, exhibiting different ſhades of red, yellow, green, and blue.

It is a native of Madagaſcar, where it is pretty common. It is a harmleſs animal, and yet is regarded with great abhorrence by the natives, who conſider it as of a poiſonous nature, and run from it with great precipitation. This popular prejudice is ſuppoſed to have ariſen from a peculiar habit of the animal, of running with open mouth towards the ſpectator, inſtead of making its eſcape when it is diſcovered. It appears chiefly in rainy weather, moving about with great agility, and ſpringing

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ing from one branch of a tree to another in ſearch of inſects, which are its proper food.

63. Lacerta Tetradactyla, *Four-toed Gecko.*

Specif. Char.—Colour yellow, varied with green; tail flat; feet tetradactylous.

This ſpecies is about 12 inches long, and is nearly allied to the preceding ſpecies, except that it wants the fimbriated margin, and the number of the toes on the fore feet being only four.

It is alſo a native of Madagaſcar, and is not held in leſs abhorrence by the inhabitants than the former. It lives in the woods, appearing in the rainy ſeaſon during the night.

64. Lacerta Caudiverbera, *Scollop-tailed Gecko.*

Specif. Char.—Tail flat, pinnatifid; feet palmated.

This ſpecies, which is a very ſingular one, is about 16 inches long, and of this the tail meaſures above one half. The head is large and flat, the body thick, and the limbs ſhort. The fore feet are like the reſt of the ſpecies, but the hind feet are ſtrongly palmated. The tail tapers gradually to the tip, but through its whole length is edged with a broad deep ſcolloped fin: this gradually widens towards the tip, and is conſiderably broader than on the ſides. The back is marked with numerous diſtant red tubercles, each of which is ſurrounded by a circle of ſmall white ſcales. The webs of the hind feet, and the finny part of the tail, are of a bright red.

This ſpecies is ſaid to be a native of Arabia; but being a very rare animal, its natural hiſtory is not well known.

65. Lacerta Schneideriana, *Schneiderian Gecko.*

Specif. Char.—Colour gray; tail convex above and flat below; a black band on each ſide of the head; lamellæ of the feet lunulated and divided.

The colour of this ſpecies is cinereous, with a brown band on each ſide of the head; on each ſide of the body there is a future or wrinkling of the ſkin; the tail is edged with a row of ſharper and longer ſcales than on the other parts.

66. Lacerta Sparmanniana, *Sparmannian Gecko.*

Specif. Char.—Body papillated above; tail lanceolated; fore feet tetradactylous.

This is a ſmall ſpecies, meaſuring not more than three inches in total length. The colour on the upper part of the body is variegated with darker and lighter ſhades; on the under part it is whitiſh.

It is a native of the Cape of Good Hope, where it is regarded as a poiſonous animal. It is ſaid that the fluid ſecreted from its pores, as well as the ſaliva, produces inflammatory tumors, and ſometimes even gangrenes.

67. Lacerta Spitator, *Spitting Gecko.*

Specif. Char.—Colour gray, marked above with brown tranſverſe bands; tail round, furniſhed with ſcuta beneath.

The total length of this ſpecies does not exceed four inches, and ſometimes it is ſmaller. The ſcales on the whole animal are ſmooth and gloſſy. Lizards.

It is a native of the iſland of Euſtatia, where it is found about houſes, walls, &c. When it is alarmed, it is ſaid to eject from its mouth a black acrid fluid, which occaſions ſlight inflammation of the ſkin, and is uſually removed by rubbing the part with camphorated ſpirit of wine.

Sect. VII. Scinks.

The animals of this diviſion are covered with rounded fiſh-like ſcales.

68. Lacerta Scincus, *Officinal Scink.*

Specif. Char.—Colour a yellowiſh brown, with tranſverſe brown bands on the upper part of the body; tail ſhort, compreſſed at the tip; upper jaw longeſt.

The ſcink is from ſix to ſeven inches long, and ſometimes more. The head is rather ſmall, the body thick and round, and the tail in general ſhorter than the body. The ſurface of the body has a gloſſy appearance.

This ſpecies is a native of many of the eaſtern countries. It is very common in Libya, Syria, Egypt, and Arabia, frequenting dry and ſandy ſoils. It was once in conſiderable eſtimation as a medicine, in leprous and ſimilar diſeaſes.

This animal is deſcribed under the name of *el adda*, by Mr Bruce, and is repreſented as very common in the province of Atbara in Abyſſinia. "It burrows, ſays he, in the ſand, and performs this operation ſo quickly, that it is out of ſight in an inſtant, and appears rather to have found a hole than to have made one; yet it comes out often in the heat of the day and baſks itſelf in the ſun, and, if not very much frightened, will take refuge behind ſtones, or in the withered ragged roots of the abſinthium, dried in the ſun to nearly its own colour. Its length is rather more than ſix inches; though its legs are long it does not make uſe of them to ſtand upright, but creeps with its belly almoſt cloſe to the ground. It runs, however, with very great celerity. It is very long from its ſhoulder to its noſe, being nearly two inches: its body is round, having ſcarce any flatneſs in its belly; its tail, too, is perfectly round, having no flatneſs in its lower part; it is exceedingly ſharp-pointed, and very eaſily broken. Yet I have ſeen ſeveral, where the part broken off has been renewed, ſo as ſcarcely to be diſcernible. It is the ſame length between the point of the tail and the joint of the hinder leg, as was between the noſe and the ſhoulder of the fore leg; its forehead from the occiput is flat; its ſhape conical, not pointed, but rounded at the end, in ſhape of ſome ſhovels or ſpades: the head is darker than the body, the occiput darker ſtill. Its face is covered with fine black lines, which croſs one another at right angles like a net; its eyes are ſmall, defended with a number of ſtrong black hairs, or eyelaſhes. Its upper jaw is longer, and projects conſiderably over the under. Both its jaws have a number of ſhort, fine, but very feeble teeth; and when holding it in my hand, though it ſtruggled violently to get looſe, it never attempted to make uſe of its teeth: indeed it ſeems to

turn

Lizards.

turn its neck with great difficulty. Its ears are large, open, and nearly round. Its body is a light yellow, bordering on ſtraw colour, croſſed with eight bands of black, almoſt equally diſtant, except the two next the tail. All theſe decreaſe both in breadth and length, from the middle towards each extremity of the animal. The ſcales are largeſt along the back. They are very cloſe, though the diviſions are ſufficiently apparent. Their ſurface is very poliſhed, and ſeems as if varniſhed over. Its legs, from the ſhoulder to the middle toe, are nearly an inch and three quarters long. Its feet are compoſed of five toes, the extremity of which is armed with a brown claw of no great ſtrength, whoſe end is tipped with black."

The ſame author, ſpeaking of the immenſe multitudes of lizards which are found in eaſtern countries, adds, " I am poſitive that I can ſay, without exaggeration, that the number I ſaw one day in the great court of the temple of the ſun at Balbec, amounted to many thouſands. The ground, the walls, and the ſtones, were covered with them; and the various colours of which they conſiſted, made a very extraordinary appearance, glittering under the ſun, in which they lay ſleeping and baſking."

69. Lacerta Rufescens, *Greater Scink.*

Specif. Char.—Colour yelloviſh, rufous; feet ſhort; tail of moderate length.

This ſpecies ſometimes exceeds 15 inches in total length. The head is covered in front with large angular ſcales; the legs are ſhort and thick; the feet pentadactylous, and furniſhed with ſmall claws.

It is a native of Arabia and Egypt, living both on land and in water. It is frequent on the ſhores of the Nile. It is alſo met with in ſome European iſlands, and particularly in the iſland of Cyprus.

70. Lacerta Longicauda, *Long-tailed Scink.*

Specif. Char.—Colour olivaceous yellow; tail very long.

The great length of the tail in this animal forms the ſpecific diſtinction; the colour, which is greeniſh yellow, varies in the ſhade in different individuals.

It is ſaid to be a native of America, and frequents the ſea coaſts, where it feeds on ſmall crabs and ſpiders.

71. Lacerta Mabouya, *Mabouya Scink.*

Specif. Char.—Colour golden yellow; ſides browniſh; jaws equal; tail of middling length.

The length of this ſpecies is about eight inches; it greatly reſembles the common ſcink, but differs from it in the length of the legs, and the jaws being equal.

It is a native of America, of Jamaica, and ſome other Weſt India iſlands. It is alſo found in the iſland of Sardinia.

72. Lacerta Occidua, *Galliwaſp.*

Specif. Char.—Colour browniſh; tranſverſe bands ſomewhat waved; legs ſhort; tail of middling length.

Except being larger, ſomewhat thicker, and having a tail proportionally ſhorter, this ſpecies comes very near the greater ſcink. It is about two feet in total length. The teeth are ſmall in front; but as they approach the back part of the jaws, they gradually increaſe in ſize, like the *molares* teeth of the mammalia. Lizards.

The galliwaſp is a native of the American iſlands. It is very common in woody and marſhy places in Jamaica, and has been reckoned, but without foundation, a poiſonous reptile.

Var. *Lacerta ſcincoides*, auſtralaſian galliwaſp.—This, although it is of a darker colour, has a longer tail, and larger ſcales, is conſidered only as a variety of the former. On each ſide of the neck there is commonly a longitudinal brown ſpot.

It is a native of New Holland.

73. Lacerta Guttata, *Spotted Scink.*

Specif. Char.—Colour gray, ſpotted with white; tail long, marked with four tranſverſe black bands, and black tip.

This ſpecies does not exceed three inches in length. It is a native of the Ural deſert.

74. Lacerta Ocellata, *Ocellated Scink.*

Specif. Char.—Colour greeniſh gray, white beneath, marked above with roundiſh ocellated brown ſpots, which have white rectangular diſks.

This ſpecies is about a ſpan long. The body is depreſſed; the feet are ſhort and pentadactylous. It has no femoral warts.

It is a native of Egypt, and frequents houſes.

Sect. VIII. Salamanders, *Newts* or *Efts.*

The ſpecies included under this ſection have ſoft ſkins, and ſome of them are water lizards.

75. Lacerta Salamandra, *Salamander.*

Specif. Char.—Colour black, ſpotted with golden yellow; tail round, and of moderate length.

The colours of the ſalamander afford ſufficient marks of diſtinction. It is of a deep ſhining black, variegated with large oblong and irregular ſpots of bright orange yellow. The ſides are marked with many large tranſverſe wrinkles. The parotid glands form protuberances on each ſide of the head. On the back and ſides of the body there are ſeveral large open pores, from which is exſuded a peculiar fluid, which ſerves to lubricate the ſkin. This fluid is of an acrid nature; and when the animal is irritated, is copiouſly ſecreted, and even it is ſuppoſed, ejected to ſome diſtance for its defence. It is in general from ſeven to eight inches in length. Sometimes it is ſeen entirely black.

The ſalamander is a native of many parts of Germany, Italy, France, and other parts of Europe, delighting in moiſt ſhady places, woods, &c. During the winter it conceals itſelf in receſſes under ground, in the cavities of old walls, or about the roots of old trees.

This ſpecies lives chiefly on inſects, ſmall ſnails, &c. It is capable of living in waters as well as on land, and ſometimes reſorts to ſtagnant pools. It is ſlow in its motions, and torpid in its manners.

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The ſalamander is viviparous. The young are produced perfectly formed in the ſame way as the viper. It is ſaid that it retires to the water to depoſit its young, the number of which at one birth amounts to 30 or 40, and when they are firſt excluded, they are furniſhed with branchial fins on each ſide of the neck, which are temporary organs, and are afterwards obliterated like thoſe of the tadpole.

Many popular errors concerning the ſalamander have long prevailed. One of theſe was, that it was a venomous animal, and that its poiſon is of ſo malignant a nature, as ſcarcely to admit of any remedy. It is now, however, found from the obſervations of later naturaliſts to be perfectly innocent, and although the fluid ſecreted from the ſkin may be noxious to ſmaller animals, it is incapable of inflicting either wound or poiſon on any large animal. In an experiment made on purpoſe, a gray lizard, which had bitten a ſalamander, and ſwallowed ſome of the fluid ſecreted from the ſkin, was almoſt immediately ſeized with convulſions, and ſoon after died. It was another popular error that the ſalamander could exiſt uninjured in the fire, and that it could even extinguiſh it by means of the fluid ſecreted from its ſkin. This fluid, it is probable, is ſecreted in greater abundance when the animal is expoſed to heat, and thus it is protected for a ſhort time againſt the action of the fire, which can produce no effect till the moiſture on the ſkin is evaporated; and from this circumſtance, and haſty obſervation, has ariſen the improbable ſtory of its being able to reſiſt the action of fire.

76. Lacerta Vulgaris, *Common Newt.*

Specif. Char.—Colour yelloviſh brown; dorſal line double; abdomen orange coloured, ſpotted with brown.

This ſpecies is the ſmalleſt of the Britiſh lizards, the general length not exceeding three inches and a half.

It is a native of Europe, and is found in gardens in the neighbourhood of dunghills, &c. Like the ſlug and toad, it makes its way into cellars. It is altogether a land ſpecies, and it ſeems to be viviparous; for ſome of a very ſmall ſize, yet perfectly formed, have been diſcovered at a very great diſtance from any water.

77. Lacerta Palustris, *Great Water Newt.*

Specif. Char.—Colour blackiſh; ſides ſpeckled with white; abdomen orange, with irregular black ſpots.

This ſpecies is ſmaller in ſize, and marked with a different diſtribution of colours, but in its general appearance it bears a conſiderable reſemblance to the ſalamander. It is from five to ſix inches in length. The tail is flat, with thin ſharp edges, and terminating in a point; on each ſide of it in the male there is a ſilvery white broad band, accompanied with a bluiſh tinge. This ſtripe and the dorſal creſt are ſometimes wanting in the female.

It is a native of Europe, but is rare in Britain. It frequents ſtagnant waters in cool ſhady places, and lives entirely on inſects. It is to larger animals quite innoxious; but the fluid exſuded from its ſkin ſeems to act as a poiſon on ſmall animals.

78. Lacerta Aquatica, *Common Water Newt.*

Specif. Char.—Colour olive brown, ſpotted with black; abdomen orange-coloured; tail ſharp-edged and ſinuated.

The general length of this ſpecies is from three to four inches. The male is readily diſtinguiſhed from the female by a conſpicuous dorſal creſt, which is more elevated, and more regularly ſinuated than that of the former ſpecies. This broad creſt is very tranſparent, and when examined with a magnifying glaſs, ſhews the ramifications of the blood veſſels and the circulation of the blood. In the female the dorſal creſt is nearly wanting. The colour of the male is olive brown, marked with numerous round black ſpots, which are largeſt on the ſides and tail. The female is of a pale yelloviſh brown, and the ſpots are much leſs diſtinct. The fore feet are tetradactylous; the hind feet pentadactylous, and in all the claws are wanting; but with regard to the colour, the breadth of the tail, and that of the toes, it ought to be obſerved, that the water newt, at different times of the year, different ſtates of the weather, and even in the courſe of the ſame day, is ſubject to conſiderable variation.

This ſpecies is a native of Europe, and is met with in Britain in all ſoft ſtagnant waters.

This animal breeds early in the ſpring, and depoſits ſmall oblong ſtrings or cluſters of ſpawn. The ova, according to Spallanzani, are of a kidney ſhape, and the larva are ready formed, becauſe long before they leave the gluten, their motions are briſk and frequent. In about 10 days they extricate themſelves from the gluten. When they are firſt excluded, the branchial fins are diſtinctly ſeen, and ſoon after the fore legs appear. After a fortnight the hind legs are viſible, and about the beginning of September the branchial fins become obliterated, and the animal aſſumes its perfect form. While the animal remains in the larva ſtate, it is furniſhed with a triple pair of ramified branchial fins on each ſide of the neck, which gives it the appearance of a ſmall fiſh.

The water newt frequently caſts its ſkin, which may be occaſionally ſeen floating on the waters which they frequent, and is ſometimes ſo perfect as to repreſent the whole form of the complete animal. The reproductive power of the water newt is a ſtriking circumſtance in its natural hiſtory. They have been known to have their legs, tails, and even the eyes, according to ſome, completely reſtored, after they were cut off or deſtroyed. This animal is alſo remarkable for its tenacity of life. Caſes have occurred in which the water newt has been found completely incloſed in a maſs of ice, in which it muſt have remained for weeks, or even months, and yet, when the ice is melted, the animal was reſtored to its former health and vigour. Yet it is very readily deſtroyed by the application of certain ſubſtances. The water newt immerſed in ſalt water, ſoon dies; or even by having common ſalt rubbed on the back for a ſhort time.

79. *Leverian Water Newt.*

This is a very large ſpecies of the water newt, deſcribed by Dr Shaw, and of which there is a ſpecimen in the Leverian muſeum. The total length is 17½ inches, and

Lizards. and of this the tail meaſures 6½ inches. The head is flattened, the mouth moderately wide, and the upper jaw is furniſhed in front with two concentric rows of numerous, ſmall, briſtly teeth. The under jaw has only a ſingle row. The eyes are ſmall, round, and ſituated on each ſide of the front of the head, ſo that they are very remote from each other. The colour is pale brown, marked in a confluent manner with darker variegations. The legs are about one inch in length, and they are all furniſhed, along their whole length behind, with a dilated ſkin or creſt. The tail is like that of the common water newt, but is ſhorter, and leſs deeply finned.

Its native country, and farther particulars of its natural hiſtory, are unknown.

80. LACERTA MACULATA, *Spotted Water Newt.*

Specif. Char.—Colour blackiſh; a double row of white ſpots down the back.

The length of this ſpecies is about five inches. The head is large; there are four toes on the fore feet, and five on the hind. The colour is deep brown, and the double row of white ſpots, which begins at the top of the head and continues to the tail, becomes a ſingle row to the end.

It is a native of Carolina, and inhabits ponds, ditches, and ſtagnant waters.

Sect. IX. SNAKE LIZARDS.

The ſpecies belonging to this ſection have very long bodies, and ſhort legs.

81. LACERTA CHALCIDES, *Chalcides Lizard.*

Specif. Char.—Colour ferruginous; feet tetradactylous; body long, and marked with ſix brown dorſal lines.

The uſual length of this animal is about eight or nine inches; but it is ſometimes found only a few inches long, and ſometimes exceeds a foot. The head is anteriorly covered with large ſcales; the ſnout is tapering; the eyes are ſmall, and the openings of the ears are very diſtinct. The colour is ferruginous or chefnut brown above, and yellowiſh brown beneath.

This animal is a native of Africa and the warmer parts of Europe, frequenting moiſt ſhady places. It is quite inoffenſive, and feeds on inſects, ſmall worms, &c. The motions of the chalcides are rather ſlow. It is viviparous, and is ſaid to produce a great number of young.

82. *Annulated Chalcides. Chalcide* Cepede.

This is nearly allied to the former, but differs from it in having ſquare ſcales, and in being marked through its whole length with a continued ſeries of annuli or rings, to the number of 48. The length of the body is about 2½ inches, and is ſomewhat ſhorter than the tail. The feet are ſhorter than in the former ſpecies, and are all tetradactylous.

The native country of this ſpecies is unknown.

83. LACERTA SERPENS, *Serpent Lizard.*

Specif. Char.—Head, body, and tail cylindrical; feet ſmall, remote, pentadactylous.

The length of this ſpecies is about 5½ inches. The colour is cinereous or pale ferruginous above, marked with from 15 to 20 duſky lines; beneath it is aſh coloured, with a ſilvery gloſs. It is entirely covered with imbricated ſcales. Lizards.

This animal is a native of Java.

84. LACERTA ANGUINA, *Snake Lizard.*

Specif. Char.—Body long; tail very long; feet oval-ſhaped, and without toes.

The body of this ſpecies meaſures four, the whole length 15 inches. The colour is brown above, aſh-coloured on the ſides, yellowiſh beneath, and the upper ſurface is marked throughout its whole length with ſeveral dark ſtripes. The head is ſmall; the legs very ſhort, and placed near the head and vent, and ſeemingly terminated in one undivided proceſs. The whole body is covered with ovate ſcales.

It is a native of the Cape of Good Hope, and is frequently found in the water, and about the rocks in Table bay.

85. LACERTA APUS, *Apodal Lizard.*

Specif. Char.—This ſnake-formed lizard is ferruginous, has no fore feet, and its hind feet are very ſhort and monodactylous.

The chalcides itſelf does not approach ſo near to the ſnake tribe as this large and ſingular ſpecies of the lizard. It meaſures almoſt three feet in length, and its general appearance bears ſuch a ſtriking reſemblance to a large ſnake, that it requires a very attentive examination to aſcertain the difference; as it has only a pair of extremely ſhort pointed proceſſes by way of feet, at a great diſtance from the anterior parts of the body, almoſt on either ſide of the vent, and without toes. The head is rather large, and covered with large ſcales; the ſnout is tapering; the upper jaw projects a little over the lower; the mouth is of a moderate wideneſs, and the ears are very viſible. There is no appearance of a neck, as the body gradually tapers from the head to the extremity of the tail, which is longer than the body, and terminates in a point. The whole animal is covered with rows of ſcales of a moderately large ſize, in a longitudinal direction, and emarginated at the tips. From the head to nearly half the length of the tail, a deep continued channel runs along each ſide of the body. Its colour is a pale chefnut, and beneath a pale yellow-brown.

Two ſpecimens of this lizard were brought from Greece by Dr John Sibthorp, profeſſor of botany in the univerſity of Oxford. It is rather a ſingular circumſtance that an animal of ſuch magnitude ſhould have remained ſo long unknown to the inquiſitive naturaliſt.

It is a native of Greece, of the ſouthern parts of Siberia, and unqueſtionably of many other parts both of Europe and Aſia, although the knowledge of it has been but lately acquired, the firſt deſcriber of it being Dr Pallas, by whom it was found in the ſouth of Siberia. It frequents moiſt and ſhady places, and, as far as is yet known, is an innocent animal.

86. LACERTA BIPES, *Biped Lizard.*

Specif. Char.—Long bodied, cylindrical, pale yellow, ſpeckled

Anatomy. speckled with brown, having no fore feet; hind feet very small, and didactylous.

This species, which is not larger in diameter than that of a goose quill, measures about six inches in length; its colour is a pale yellow, spotted with brown; the head is small, body cylindrical, tail short and taper; on each side of the vent there is a small subulated foot, which is furnished with two small unequal toes.

It is a native of India and South America.

87. LACERTA LUMBRICOIDES, *Lumbriciform Lizard.*

Specif. Char.—Body cylindrical, two-footed, and annulated with square scales, having a lateral furrow, and no hind feet.

This is about eight inches long, and half an inch in diameter. The whole body, including head and tail, is of the same diameter, and is covered with rings of square scales. Along each side there is a continued furrow, which separates the upper and lower surfaces. The legs are two, very short, and placed near the head. They are divided into five minute toes, which are furnished with claws. The colour of the living animal is supposed to have been green, and paler beneath. Anatomy.

It is a native of Mexico.

Number of species in each genus, included under the order *Reptilia*.

TESTUDO,	39
RANA,	48
DRACO,	2
LACERTA,	87
Total	176

CHAP. II. OF THE ANATOMY AND PHYSIOLOGY OF REPTILES.

HAVING in the former chapter taken a brief and comprehensive view of the classification, and such particulars of the natural history of reptiles, as were connected with the different species, we now proceed to give a slight sketch of the anatomy and physiology of this order of animals. These shall be the subjects of the two following sections. In the first we shall treat of the anatomy, in the second of the physiology of reptiles.

SECT. I. *Of the Anatomy of Reptiles.*

BETWEEN this order of animals, and the quadrupeds belonging to the class mammalia, there are many points of resemblance, making allowances for the difference of size; and hence they have been denominated *oviparous quadrupeds*. This resemblance, however, only extends to external appearance.

The body of reptiles is supported by four feet, and these form the principal external character. They are disposed like those of the mammalia, two before and two behind. With the exception of some animals which have been arranged under this order, and which have only two feet, all reptiles are furnished with four feet.

The body is furnished with a tail, which is different from that of quadrupeds, in having no hair. This is common to the tortoises and the whole of the lizard tribe. The genus *rana* is an exception to this. All the species included under it are unprovided with a tail.

The body is either lengthened, that is, when it is considerably longer than broad, as is the case with lizards; or rounded, that is, when the body, seen from above, exhibits an orbicular form, as in the tortoise and some toads.

With regard to the surface of the body, it is never covered with hairs, but sometimes with scales; such are reptiles without a tail, the salamanders and some lizards. It is sometimes covered with inequalities or asperities, the whole surface being rough with elevated points, which resemble warts or pustules. This is the case with some lizards, and several frogs and toads. The body is covered sometimes with a shell both above and below; this bony covering protects the animal from external injury. With such a covering the genus tortoise is furnished.

In the sketch which we propose to give of the anatomy of reptiles, the parts of the body may be divided into external and internal; the external parts comprehend the head, the trunk, the tail, and the feet. Under the internal parts are included the skeleton, the muscles, and the viscera.

External Parts of the Body.

1. The HEAD.—The head is that part of the body which is articulated with the first vertebra of the neck. It is rounded, that is, when its external surface is round in every direction, as is the case with tortoises; or flattened or depressed, when it is compressed above and below, which is the case with almost the whole order; or triangular, when the head, seen from above, represents a triangle, as in some toads and frogs.

The mouth is semicircular, when the outline forms a semicircle, as in the genus *rana*, and in almost all the lizard tribe; or inferior, when the upper jaw comes over the lower, so that the mouth necessarily occupies the lower part of the head. This is the case with the tadpole.

The beak or snout either forms an inclined plane from the top of the head to the end of the jaws, as in the chameleon, and many lizards; or conical, when the two jaws gradually diminish, as in the crocodile; or reflected upwards, when both jaws are flattened and turned upwards towards the extremity of the beak; or rounded, when they are thick and ventricose towards the extremity, as in several tortoises; or pointed, when the upper jaw terminates like the beak of a bird.

The jaws are either equal, as in most part of the genus *rana*, in many of the lizards, and salamanders; or unequal, as is the case with many of the tortoises and lizards, in which case, the upper jaw is always the longest. Among the whole order of reptiles, there is

no

Anatomy. no inſtance of the contrary; that is, of the lower jaw being longeſt, and perhaps this ſtructure would be inconvenient, or incompatible with the nature of the animal, or its habits and mode of life.

A common error long prevailed with regard to the motion of the jaws of the crocodile. It was aſſerted, that this animal only moved its upper jaw; but the more accurate obſervations of later anatomiſts have proved the contrary, and that the articulations of the head and jaws of this animal are preciſely the ſame as in other quadrupeds. The head is articulated with the laſt vertebra of the neck, and the lower jaw is articulated with the upper, ſo that the former, namely the lower jaw, only has the power of motion.

All the animals belonging to the order of reptiles, are not furniſhed with teeth. The tortoiſes and ſome lizards, have none. All the ſpecies belonging to the genus *rana* may be conſidered alſo as having none, the jaws being only crenulated or notched; but in other tribes belonging to this order, the teeth are conical, as thoſe of the crocodile, which are hollow, and filled with a ſoft ſubſtance; or recurved, when the extremity of the tooth turns backward towards the throat, as in the Indian crocodile; or ſtraight, as in moſt of the lizard tribe; compreſſed at the ſides, as in the guana; or notched, when the ſummit of the tooth is truncated and crenulated, as in the horned lizard.

Tongue.—In almoſt all the tribes of animals belonging to this order, the tongue is peculiarly fitted for ſeizing their prey. The form of it varies in all the families. Another error has prevailed with regard to the tongue of the crocodile. It was ſaid that it had no tongue, but in place of it is furniſhed with a ſtrong membrane, which adheres to the two edges of the lower jaw. Even the obſervations of later naturaliſts tend to confirm this error. Denon, who had numerous opportunities of ſeeing the crocodile both dead and alive, in its native haunts on the borders of the Nile, believes in this opinion, that the crocodile has no tongue; but it does not appear that any accurate anatomical inſpection was made, to aſcertain this point, or indeed that he was accompanied by any anatomiſt at all, by whom alone the truth or falſehood of the opinion could be inveſtigated. This organ of the crocodile, however, is very large, and even proportionally larger than that of the ox, but it is ſtrongly connected with the ſides of the lower jaw, and being thus fixed or tied down, cannot be ſtretched forwards, as is the caſe with other animals.

Tongue of the crocodile.

In ſome of the animals belonging to this order, the tongue is nearly of equal length and breadth. This is the caſe with the tongue of frogs, tortoiſes, the ſalamander, and the guana.

In ſome it is very narrow at the baſe, and divided in two at the extremity, as in moſt of the lizard tribe, which are thus furniſhed with a bifid tongue.

Of the chameleon. But the ſtructure of the tongue of the chameleon, is perhaps the moſt ſingular of any belonging to the order. It is compoſed of a white ſolid fleſh, 10 inches long, and about three broad. It is round, and flattiſh towards the end; hollow and open, ſomewhat reſembling the termination of the trunk of the elephant. The tongue is attached to the os hyoides by a kind of trunk, of the ſhape of an inteſtine, about ſix inches long, and a line in breadth. This trunk is furniſhed externally with a membrane, and internally with a ſoft, but ſolid and compact, nervous ſubſtance, which is with difficulty divided into fibres. It is by means of this trunk that the tongue, which is attached to it, is projected from the mouth. This is done by the extenſion of the trunk, and it is again drawn back by its contractile power. Theſe motions are performed by a kind of cartilaginous ſtilus, to which the inveſting membrane is attached, and over which it is plaited like a ſilk ſtocking on the leg. This ſtilus is an inch long, and originates from the middle of the baſe of the os hyoides. In conſequence of this extenſile and retractile powers which the tongue of the chameleon poſſeſſes, it has obtained the epithet of *vermiform*, becauſe in thoſe motions it reſembles thoſe of an earth-worm. Anatomy.

There is no great peculiarity about the noſtrils of any of this order of animals. In general, they are almoſt always of a round form. In ſome, however, they are lunulated, or ſhaped ſomewhat like a creſcent, the horns of which are turned backwards. This is the caſe with the noſtrils of the crocodile. Noſtrils.

The eyes, as in moſt other animals, are placed on the ſides of the head; but in ſome they are vertical, or placed on the top of the head, as in ſeveral of the toads and the crocodiles; approximating, when the diſtance between the eyes is very ſmall; or protuberant, when the globe of the eye on each ſide forms a conſiderable projection, as in thoſe belonging to the genus *rana*, the *crocodiles*, and the *ſalamanders*. Eyes.

The nictitating membrane, which is peculiar to ſome birds, belongs alſo to ſome of the animals of this order. By means of extending this membrane over the eye, the exceſſive brightneſs of ſunſhine, to which many of them, being natives of warm climates, are expoſed, is greatly moderated, and perhaps this membrane may be uſeful to thoſe animals of this order which frequent the water.

The iris of the eye is differently coloured in the animals of this order. In many it is red; in the chameleon it is of a golden yellow colour.

Externally, the ears of reptiles do not exhibit any remarkable peculiarity. The opening is more or leſs round, and it is uſually covered with a membrane. There is no external ear, by which the vibrations of the air might be collected, and conveyed to the ſenſe of hearing; from which it has been concluded, that this ſenſe is more obtuſe than in quadrupeds. Ears

2. The TRUNK.—The trunk of the body includes the neck, the breaſt, the back, the ribs, the abdomen, and the anus; and ſome of theſe parts in different reptiles, preſent conſiderable varieties.

The neck, which unites the head with the trunk, is very different in the different tribes belonging to this order. In all thoſe included under the genus *Rana*, the head is ſo cloſely attached to the trunk, that the neck is ſcarcely to be diſtinguiſhed. In others, however, it is conſiderably elongated, and quite diſtinct, as in the crocodile and the ſalamander. The neck is alſo pretty long in ſome of the tortoiſes. Sometimes it is covered with wrinkles or folds, when the ſkin forms ſeveral tranſverſe wrinkles, as in the neck of ſome of the tortoiſes. Neck.

The breaſt or thorax is ſituated on the anterior part of Thorax.

Anatomy. of the trunk; it forms a close cavity which is covered beneath by the sternum, on the sides by the ribs, and above by the vertebræ at the back bone.

The back is the upper part of the trunk, extending from the last vertebra of the neck to the first of the tail. In reptiles it is sometimes convex, sometimes more or less flattened. It is either furnished with scales, when there extends along the superior surface a row of scales from the neck to the extremity of the tail, as in the guana and horned lizard; or it is furnished with a toothed suture, when the upper extremity of the trunk terminates in a notched ridge, as in the chameleon of the Cape; or is supplied with a kind of radiated fin, somewhat resembling the fin of a fish, as in the basiliſk; or it is protected with a strong bony covering, known Calipash of the turtle. by the name of *calipash*. This is the name by which the bony covering of the turtle is distinguished. This covering is composed of different pieces closely united to each other, and they are sometimes smooth and convex, sometimes striated and flat, disposed in three rows; and there are about 24 pieces situated on the edges of this covering.

Ribs. The ribs include the lateral parts of the trunk, from the neck to the anus. In the tortoises, the ribs are defended by the edges of the calipash, which is here united with the inferior shell, or bony covering.

Abdomen. The abdomen or belly constitutes the inferior part of the body, and extends from the extremity of the breast or thorax to the anus. In the tortoises, this part is composed of a bony covering; and in some species belonging to this tribe, there are openings in those places which correspond to the head, the four feet, and the tail; but in some other species, as in the *testudo clausa*, there is no opening whatever, but the bony covering is transversely divided into two parts, which play on a kind of hinge, so that when the animal wishes to move, it opens the anterior division to put out the head and the fore feet; and in the same way for the opening behind. This inferior bony covering is united with the upper one by means of a cartilage placed near the middle of the body. This is usually known by the Calipee. name of *calipee*. Sometimes the abdomen is covered with plates or scuta, which is the case with most of the lizards, which have on the inferior surface of the body, very large plates regularly arranged.

The anus is not only the passage for the evacuation of the excrement, but is besides the canal in which are contained the parts of generation of the male lizards and tortoises. The males of the animals belonging to the genus *Rana*, which are destitute of these parts, eject by this opening the fluid which impregnates the ova of the female.

3. The Tail.—This part terminates the trunk. Many reptiles, as those belonging to the genus *Rana*, have no tail whatever; but the animals belonging to the other genera of this order are furnished with a tail of different lengths. The tail is covered with scales, as in almost all the lizards; and these scales are sometimes disposed in rings or circular bands, as in several lizards; or they are somewhat elevated, forming a kind of notched appearance on the upper surface of the tail, as in the guana.

4. The Feet. The feet of the animals belonging to this order greatly resemble those of quadrupeds; their position and articulations are nearly the same, but they are much shorter, and placed at a greater distance Anatomy. from each other. The feet terminate in a certain number of toes, and thence, according to the number of the toes, assume different names; as tridactylous, tetradactylous, &c. The structure of the toes is similar to that of other animals. They are separated from each other, as in lizards; palmated, when united by means of an intermediate membrane, as in the hind feet of the frog; furnished with nails or claws at the extremity, which are sometimes flat, as in the frogs; or hooked, as in the lizards; or destitute of nails or claws, as in the salamander.

Internal Parts.

Under the internal parts are included the skeleton, the muscles, and the viscera.

1. The Skeleton.—With regard to the skeleton of reptiles, it may be observed, that the structure of the bones is less complicated than that of quadrupeds, and the texture is less compact. They possess at the same time somewhat of the transparency of cartilages. The bones may be divided into those of the head, the neck, the thorax, the spine, the tail, and the feet.

The bones of the head are composed of those of the Bones of cranium, and those of the lower jaw. In the greatest the head. number of reptiles, the cranium consists of a single bone. The bone of the upper jaw, and that of the forehead, are completely united in the crocodile, the chameleon, and some others. They do not seem to be separated by any distinct suture. The lower jaw of the chameleon terminates on each side in a separate bone, which unites on one hand with the region of the temples, and forms on the other an angular articulation with the jaw.

The bones of the neck are composed of a series of Of the vertebræ, the number of which varies in the different neck. tribes of this order. The species belonging to the genus *Rana* have no cervical vertebræ; but in the other tribes the number varies, as has been mentioned, as will appear from the following table.

	Number of vertebræ.
Chameleon,	2
Most of the Lizards,	4
Crocodile,	7
Tortoise,	8

The number of processes with which the vertebræ are furnished, also varies. In those of the chameleon there are seven; but in those of the crocodile, there are nine, viz. five above, and four below.

The bones of the thorax comprehend those of the Of the tho- vertebral column, corresponding to this cavity, the ribs, rax. and the sternum. The vertebræ, which correspond to the cavity of the thorax, are not the same in all the individuals belonging to this order. In the crocodile there are only 12, but in the chameleon, the number amounts to 18. Each of these vertebræ is in general furnished with seven processes, which are sometimes simple, and sometimes spiny.

The ribs are wanting in the reptiles belonging to Ribs. the genus *Rana*: the salamander also is destitute of ribs. In the other tribes they are always found, but unequal in number. In the tortoise there are eight on each side; in the crocodile 12; in the chameleon 18. The ribs

Anatomy. ribs are articulated with one vertebra only; but in the ſtructure and articulations of theſe bones there is a peculiarity in the crocodile and chameleon. The two firſt and the two laſt ribs of the crocodile do not terminate in the ſternum. The cartilages which attach the other eight are broken, ſo that each rib from the vertebra to the ſternum is compoſed of three parts, one of which is bony, the other two cartilaginous. In the chameleon the two firſt anterior ribs are not ſupported by the ſternum; the four following are attached to it by means of appendages which form at the point of junction an angle with the ribs, and which are not compoſed of a ſubſtance purely cartilaginous, but as hard as that of the ribs. The 10 other following ribs do not reach the ſternum. Each is joined to that which is oppoſed to it by a bony appendage, forming an arch on the middle of the thorax and abdomen. The three laſt are looſe, ſeparated, and as it were truncated in the middle.

Sternum. The ſternum or breaſt-bone is a flat bone, placed on the anterior part of the thorax, the figure and dimenſions of which vary conſiderably. In the crocodile this bone reaches to the third rib; it is compoſed of a ſingle piece, having at its upper part a kind of cartilage which forms a point towards the throat, and which enlarging at the ſides covers the clavicles. The ſternum of the chameleon and the frog is compoſed of four bones, the firſt of which is very large.

Spine. The back-bone comprehends the vertebræ which occupy the upper part of the back, including thoſe of the loins. In the chameleon there are 22; in the crocodile 19, and in the gray lizard 22.

The vertebræ of the tail form the poſterior extremity of the ſpiral column. Their number is always proportional to its length. The tail of the chameleon is furniſhed with 50 vertebræ; that of the crocodile 33, and that of the gray lizard 60. All theſe vertebræ are furniſhed with tranſverſe, oblique, and ſpinous proceſſes, excepting thoſe towards the end of the tail, which are uſually deſtitute of the oblique proceſſes.

Feet. The bones of the feet bear a conſiderable reſemblance to thoſe of other animals. The fore feet are compoſed of the ſcapula, the humerus, the cubitus and radius, the bones of the carpus and metacarpus, and the joints of the toes.

Scapula. The ſcapula or ſhoulder-blade is ſometimes ſingle, and ſometimes double, in the animals belonging to this order. The frog, the chameleon, and the ſalamander, have only one; but it is of ſuch a length that it extends from the dorſal ſpine to the ſternum, with which it is articulated, anſwering the purpoſe of a clavicle. In the tortoiſes and crocodile, there are two ſhoulder-blades, viz. one on the back, and one placed anteriorly, and articulated with the ſternum. Theſe alſo perform the functions of the clavicle. The humerus is articulated on the one hand with the ſcapula, and with the two bones, the cubitus and radius of the arm, on the other. The two latter bones, the cubitus and radius, are placed parallel to each other, between the humerus and the bones of the carpus and metacarpus. Theſe latter are ſituated between the two bones of the fore-arm, and the phalanges or joints of the toes.

The hind feet are compoſed alſo of the femur or thigh-bone, the tibia, and the peronea of the leg; the bones of the tarſus and metatarſus, and the phalanges or joints of the toes. Theſe, excepting that they differ ſomewhat in ſtructure, bear ſo near a reſemblance to thoſe of the fore feet, that it would be quite unneceſſary to enumerate or deſcribe them particularly. Anatomy.

2. The Muscles.—The muſcles are the inſtruments of motion. The muſcles of the back of the crocodile take their origin from the vertebræ and ribs, and they are attached by means of their tendons, to the bands or rings which are formed by the tubercles of the back. Theſe tendons act in different directions; ſome of them pull theſe bands from above downwards, while others pull them from below upwards. The uſe of theſe muſcles is apparently to lock together more ſtrongly the rings of which the tubercles of the back are compoſed. Muſcles of the back.

The muſcles of the abdomen in the ſame animal, which are four in number, one external, and one internal on each ſide, are not only different from thoſe of other quadrupeds in number, but alſo in their ſituation and ſtructure. The external muſcle is placed upon the ribs, and the internal under them, immediately above all the viſcera, which it embraces in the manner of a peritoneum. The internal muſcle is attached on one ſide to the bones of the pelvis, and to the tranſverſe proceſſes of the lumbar vertebræ; and on the other it terminates in a broad tendon, which envelopes all the inteſtines in the form of a membrane. The fibres of theſe two muſcles are diſpoſed lengthwiſe. Of the abdomen.

3. The Viscera.—The parts contained in the three great cavities of the body are the viſcera. Theſe are the brain, the heart, the lungs, the ſtomach, the inteſtines, the liver, the ſpleen, and the kidneys.

The brain is ſituated within the cavity of the ſkull. This organ in reptiles, is in general of ſmall ſize. The brain of the chameleon, which is of a reddiſh or grayiſh red colour, is not more than a line in diameter. The ſame organ in the crocodile is very ſmall, and ſimilar to that of fiſhes. The cavity within which it is contained, does not exceed 14 lines in length, and about 12 in breadth and depth. Brain.

The heart is a ſtrong muſcular body, from which proceed the great arteries, and in which the great veins terminate. From the contractile force of this organ, the blood receives its firſt impulſe. The heart in this order of animals is ſmall. It has in general been conſidered as having only one ventricle and two auricles; differing from the heart of the more perfect animals, which is furniſhed with two ventricles and two auricles. But from the obſervations of later naturaliſts, it would appear that the ſtructure of the heart of reptiles has not been accurately deſcribed; for, according to ſome anatomiſts and phyſiologiſts, the heart of this order of animals is really double; that is, conſiſting of two auricles which have a direct communication with each other, and two ventricles, as in other animals. Heart.

The lungs which conſtitute the principal organ of reſpiration, are ſpongy cellular bodies, in which the bronchia or air-veſſels are ramified. The ſubſtance of which the lungs of reptiles are compoſed, is not fleſhy and parenchymatous like thoſe of quadrupeds, but they conſiſt of a bundle of veſicles divided into two lobes. The lungs of the turtle are remarkable for a veſicle which adheres to their ſurface on the left ſide, and which may be contracted and dilated at the pleaſure of the animal. It is conjectured, that it is by means of this Lungs.

Phyſiology. this organ, like the ſwimming bladder in fiſhes, that the turtle raiſes itſelf to the ſurface of the water.

Stomach. The ſtomach which is deſtined to receive the food, is ſituated between the gullet and the inteſtinal canal. This organ in reptiles is very like that of birds. The ſtomach of a crocodile four feet long is not larger than four inches in length, and the ſame in breadth; and although the fibres of which it is compoſed are neither ſo ſtrong, nor ſo numerous, as thoſe of the ſtomach of birds, they form a body which is incapable of extenſion or enlargement. This renders it extremely difficult to believe what is ſaid of the crocodile, of its prodigious voracity, ſwallowing animals of ſo conſiderable a ſize, ſince it is neither furniſhed with teeth fit for the maſtication of its food, nor a ſtomach of ſufficient capacity to receive ſo great a quantity.

Inteſtines. The inteſtines form a canal compoſed of different convolutions, extending from the ſtomach to the anus. It is quite unneceſſary to enter into a minuter deſcription, than merely to ſtate, that they are divided, as in other animals, into great and ſmall. In the crocodile and other reptiles, the inteſtines going out from the ſtomach, form two great convolutions ſimilar to thoſe of birds. They are afterwards convoluted in different ways, till they reach the bottom of the cavity and terminate in the anus.

Liver. The liver is the organ deſtined for the ſecretion of bile. In this order of animals it is large, and divided into two unequal lobes, between which the heart is ſituated. The right lobe is ſomewhat larger, and the gall bladder occupies the middle of this lobe.

Spleen. The ſpleen is an organ placed on the left ſide. In this ſituation it is expoſed to the preſſure of the diaphragm and the abdominal muſcles. The ſpleen of frogs is double, and of an oblong form. In the crocodile it is oval, ſomewhat oblong and equal at the two extremities. The ſubſtance of which this organ is compoſed, conſiſts of a great number of large whitiſh points on a dark red ground.

Kidneys, &c. The kidneys are bodies of an oval lengthened form, ſituated within the abdomen, and deſtined for the ſecretion of urine. In the frog, between the kidneys and the teſticles, there are certain appendages which reſemble ſome kind of leaves. The kidneys are attached to the back, having at their poſterior extremity the ſeminal veſſels. The urinary bladder is ſituated near the orifice of the anus.

Sect. II. *Of the Phyſiology, Manners, and Habits of Reptiles.*

We ſhall now, according to the arrangement propoſed, make a few obſervations on the phyſiology, manners and habits of reptiles.

From the ſmall proportion of brain, and dull habits of reptiles, it ſeems to be juſtly concluded that their ſenſes are not very acute.

Sense of Sight.—Of all the ſenſes, that of ſight is probably the moſt perfect among reptiles; but as their moſt common haunts are on the ſhores of the ocean, on the margin of lakes, and of ſtagnant waters, and on the banks of rivers, where the rays of the ſun are ſtrongly and inceſſantly reflected, it was neceſſary that the eyes of theſe animals ſhould be protected from the too powerful impreſſions of light. For this purpoſe the moveable eye-lids, and the nictitating membrane, are peculiarly fitted; as by their means the animal is enabled to diminiſh the quantity of light received into the eye. The peculiar power which many of them poſſeſs alſo of contracting and dilating the pupil at pleaſure, like the cat, and ſome other animals, which ſeek their prey in the dark, extends the utility of this organ, and renders it more ſenſible and delicate. From this peculiar ſtructure of the eye, the animal is enabled to ſee objects at a conſiderable diſtance, and is thus fitted to purſue its prey in the dark, or at great depths under the ſurface of the water; circumſtances which are highly neceſſary for the ſituation in which many of the tribes of reptiles are placed, and exactly accommodated to their habits and mode of life. Phyſiology. Peculiarities in this ſenſe.

Sense of Hearing.—This ſenſe in reptiles is probably not very acute. The ſtructure of the internal ear is conſiderably different from that of the more perfect animals. Indeed ſome of the parts which ſeem to render perception more acute, are wanting in theſe animals. There is neither *cochlea* nor *feneſtra ovalis*, and the ſemicircular canals are deſtitute of extremities. The membrane of the tympanum is very thick, and the bone immediately connected with it is of a very irregular figure. But, beſides, theſe animals have no external ear whatever, by which means the vibrations of the air might be collected, and condenſed in the ſeat of ſenſation. In place of theſe external parts, there are only very narrow openings, which can admit but a ſmall number of vibratory undulations. As a farther proof of the dulneſs of this ſenſe in theſe animals, few of them emit any ſound, excepting a harſh croaking, whence it may be concluded, that their perception of ſound is very indiſtinct, or they are deſtitute of the organs neceſſary to expreſs it; otherwiſe, with theſe requiſites, the habit of hearing diſtinctly would very ſoon improve the power of expreſſion. Not very acute.

Sense of Smelling.—Almoſt all reptiles are furniſhed with the external organs of this ſenſe. The noſtrils of the crocodile are placed in a round ſpace, filled with a black, ſoft, and ſpongy ſubſtance; thoſe of the tortoiſe and lizard occupy the extremity of the ſnout, and conſiſt of two very diſtinct openings. It appears, indeed, from anatomical inſpection, that the nerves which terminate in theſe organs are of a very large ſize, which circumſtance leads us to conclude, that the ſenſe of ſmelling muſt be pretty acute. But when it is conſidered that a great proportion of reptiles have their abode in the midſt of putrid marſhes, it would incline us to ſuppoſe, that the ſenſe of ſmelling is not very acute. Suppoſed to be more perfect.

Dr Townſon, in ſome experiments which he made with the water lizard, very juſtly concludes, that their ſenſe of ſmell is extremely acute. "I kept, ſays he, a conſiderable number of water lizards, in a jar, which I fed from time to time with worms; if they were in the greateſt ſtillneſs, and I dropt in a worm ever ſo gently, they all immediately began to fight, each attacking its neighbour and ſeizing it by the foot or tail. This was not a contention for the worm, which often lay for a ſhort time unnoticed, but it originated rather from the acuteneſs of their ſenſe of ſmell, which immediately informed them of the preſence of their food, and in the dullneſs of their diſcriminating powers. This is ſimilar to what I have invariably obſerved in frogs and toads,

Physiology. toads, which will suffer their natural food to remain before them untouched, yet seize it instantly on the smallest motion it makes. It was from a knowledge of this instinct that I was able in winter to feed my constant companion and favourite pet, Musidora.

"Before the flies, which were her usual food, had disappeared in autumn, I collected a great quantity as provision for winter. When I laid them before her, she took no notice of them; but the moment I moved them with my breath she sprung and ate them. Once when flies were scarce, I cut some flesh of a tortoise into small pieces, and moved them by the same means, she seized them, but instantly rejected them from her tongue. After I had obtained her confidence, she ate from my fingers dead as well as living flies.

"Frogs will fly at the moving shadow of any small objects, and both frogs and toads will soon become so tame as to sit on one's hand and be carried from one side of the room to the other, to catch the flies as they settle on the wall. At Gottingen, I made them my guards for keeping these troublesome creatures from my desert of fruit, and they acquitted themselves to my satisfaction. I have seen the small tree-frogs eat humble bees, not indeed without a battle; they are in general obliged to reject them, being incommoded by their stings and hairy roughness; but at each attempt the bee is further covered with the viscid matter from their tongue, and is then easily swallowed.

"Nothing appears more awkward and ludicrous than a frog engaged with a large worm or little snake; for nature seems to have put a restraint upon their voracity, by forming them very inapt to seize and hold their larger prey. One of my largest frogs, whether the *rana temporaria*, or *esculenta*, I forget, swallowed in my presence an *anguis fragilis* near a span long, which, in its struggles, frequently got half its body out again; when completely swallowed, its contortions were very visible in the flaccid sides of the conqueror *."

* *Tracts on Nat. Hist.* p. 113.

Very feeble. Sense of Taste.—If the perception of taste is to be taken in proportion to the sensibility of the organ which is the seat of it, this sense in reptiles must be considered as the feeblest of the whole. The tongue of most reptiles is rather to be considered as an instrument for seizing its prey, than as an organ destined for the perception of taste; and for the former purpose it is remarkably fitted, both from its structure and mechanism, by which means the animal can project it instantaneously from its mouth, and also from the viscid fluid which is secreted on its surface. We have already described, in speaking of the anatomy of reptiles, this peculiarity of structure in the tongue of the chameleon.

Sense of Touch.—This sense cannot be supposed to be very acute in this order of animals. Most of them have the body covered with hard scales, with large tubercles, or with a strong bony substance. In a great number belonging to this order, the extremities of the feet even are furnished with scales; and the toes are so united together, that they can only be applied with difficulty to the surface of bodies. And if in some lizards it is found that the toes are long, and distinctly separated from each other, the inferior surface is covered, either with a hard skin, or with very thick scales, which must undoubtedly deprive this part of all sensibility. The sense of touch, therefore, in reptiles, may, in general, be considered as dull and imperfect. Physiology.

Circulation of the Blood.—In animals which have been usually dignified with the name of *perfect*, and which are furnished with a double heart, the blood which has been collected from all parts of the body, returns to the right side of the heart; is thence conveyed to the lungs; from the lungs it passes to the left side of the heart, and thence is again distributed through the body. But this course of the blood can only go on when the function of respiration continues without interruption; because on the cessation of the action of the lungs, the circulation through them is interrupted; and therefore, without some other structure of the heart, the circulation through the body must stop, and the death of the animal ensue.

Peculiarity of the circulation. Many of the animals included under the order of reptiles are distinguished by a peculiarity of structure, which allows the circulation to go on during the necessary interruption of the function of respiration to which they are subjected. The blood therefore, instead of passing through the lungs, is conveyed through an oblong opening called *foramen ovale*, situated between the two auricles, and is discharged directly from the pulmonary artery into the aorta. Hence it is that these animals come under the denomination of cold-blooded. This diminished temperature of the blood is ascribed to the less complicated circulation which goes on in their system. For the blood in the course of the circulation being less exposed to the action of the air in the lungs, undergoes fewer of these changes, on which, according to the present chemical theory of respiration, the temperature of the body, or animal heat, depends.

Respiration different from that of other animals. Respiration.—The function of respiration exhibits one of the greatest peculiarities in the animals belonging to the order of reptiles. For, as in these animals the structure of the thorax, and the other parts necessary to the process of respiration in other animals are quite different, the means also by which it is conducted in them must also be different. It is to Dr Townson that we are indebted for the elucidation of this part of the physiology of reptiles. This naturalist, as he himself observes, at least revived a doctrine which had been acknowledged by former physiologists, to whom it seems to have been distinctly known. Among these he mentions Laurenti, who, in his *Synopsis Reptilium*, has derived the character of his class from the peculiar mode of respiration of these animals, of which he says that they are furnished with lungs, but are destitute of diaphragm and ribs, but by means of the gular pouch the air is alternately drawn into this reservoir, and by its contractions propelled to the lungs.

In quadrupeds, Dr Townson observes, there are no perceptible motions in the throat, excepting those which accompany the process of deglutition; but in the frog tribe, whether they are awake or asleep, if they are not excluded from the air, there are some remarkable motions of the throat which are quick and constant: these are the motions which are subservient to inspiration. The bony and muscular parts, which in hot-blooded animals are the mechanical instruments of respiration are entirely wanting in this order of amphibia. It must then be by means of some other contrivance, that they are enabled to fill the lungs with air. In the hot-blooded Process of inspiration.

Physiology. blooded animals the alternate contraction and dilatation of the thorax effects this, but in this tribe the same purpose is accomplished by the dilatations and contractions of the throat. When the cavity of the throat is enlarged the air rushes through the nostrils and fills it; the nostrils being closed by their proper muscles, the glottis is opened; the muscles designed for this office contract, diminish the cavity of the throat, and impel the air which is contained in it into the lungs; and in this way, he adds, is inspiration performed in these animals.

"When the lungs, says he, were laid bare, I have observed that these did not inflate, if the frog, exhausted with pain and loss of blood, or when the nostrils were covered with it, opened its mouth to take in a greater supply of air, till the throat contracted; this, then, was the immediate consequence. Likewise, if I put a tube down the throat, the glottis and mouth being by this kept open, the lungs collapsed, and in this state remained; but as soon as the tube was removed, respiration immediately recommenced: nothing similar to this is to be observed in hot-blooded animals

Of expiration. "Expiration is very easily accomplished; for, the glottis and the nostrils being open, the lungs by their own contraction from a state of distention, and by their own weight, aided by that of superincumbent parts, will gradually expel the air; but the muscles which cover the sides act also on this occasion, and in their croakings, (which, in the time of their amours, are heard to a great distance), with great force. But in the ordinary expirations of these animals, no more than in quadrupeds, do the lungs wholly collapse; if not viewed with attention, no motion is ever perceived in their sides, though there is a regular contraction and distention. They likewise have the faculty of compressing one lobe of the lungs singly, by the contraction of the muscles of that side; this is easily induced by touching them gently on the side with a pin or other sharp body.

"As these animals are known to be able to live a much longer time without air than those with hot blood, it has been said by many that they respire slower. But although probably they do not vitiate so much air, they respire very rapidly. Man respires about twenty times in a minute: and, according to Forgaro, birds, which breath the quickest of all hot-blooded animals, from 25 to 50; but the esculent frog (*rana esculenta*), respires about 70 times in a minute; the *rana variabilis* (a species of toad), about 100, and the tree frog (*rana arborea*), so rapidly that I could not reckon the number of the motions of its throat. The contractions of the throat I have considered as inspirations; yet, as the nostrils do not close with each contraction, I cannot venture to affirm that at each the whole contents of the throat are driven into the lungs. As there is frequently one contraction in four or five greater than the rest, it may be then that the greatest quantity of air is driven into them. When these animals sleep, and in cold weather, these motions are slower and more feeble.

"According then to the doctrine which I have advanced on the mechanism of respiration in the frog tribe, which may easily be subjected to experiment, and then thrown aside, if it bears not this test, but candidly received if it does, their lungs possess no secret power of dilatation, any more than those of hot-blooded animals. In both, this organ is inactive in respiration, which process principally differs in this, that, whilst in the *hot-blooded the air is sucked into the lungs by the expansion of the thorax; it is driven into them, in the frog tribe, by the motions of the throat.*

Physiology.

"Let us now proceed to examine anatomically the mechanism subservient to respiration; and when, for the sake of brevity, in speaking of the throat, I make use of the terms of muscles of inspiration and expiration, I mean by the former those muscles which serve for forming a vacuum in the throat, and by the latter those which serve to diminish it. Mechanism of respiration.

"Instruments of Respiration.—When the skin is stripped off from the throat, a broad muscle comes into view, which is the mylo-hyoideus. It covers the whole throat, being extended from the end of the maxilla to the condyles; its fibres run transversely, and are inserted into the maxilla through its whole length. In the middle, from the point of this bone, it becomes thin and membranous, but at the condyles thicker; it is not united with the os hyoides, as in man, but slightly connected with the skin. When the cavity of the throat is diminished, its muscular fibres are seen evidently to contract, but chiefly at the condyles, where the muscle is thickest. Thus, this muscle seems well adapted to assist in driving the air from the throat into the lungs; nevertheless, if it be cut away, respiration continues.

"The mylo-hyoideus being cut away, the genio-hyoidei appear; and, under these, in the middle, is the muscle of the tongue; the muscle at the point of the maxilla, the sterno-hyoidei and the coraco-hyoidei are likewise seen. The genio-hyoidei, which are slit where the sterno-hyoidei are inserted in the os hyoides, from their direction and connection, ought, one would think, greatly to assist in drawing the os hyoides forwards, and, by this means diminish the cavity of the throat; yet these being cut away, respiration continues.

"The sterno-hyoidei are strong and powerful; they rise from the whole length of the last bone of the sternum, and are inserted all along the os hyoides. As the os hyoides is not in the same direction as the sternum, but higher, and its cornua, which are fastened by the stylo-hyoidei, likewise higher and oblique, these muscles in their contractions draw this bone downwards and backwards, and thus form a cavity in the throat. These are the principal muscles used in forming this cavity, and when they are cut respiration ceases.

"The coraco-hyoidei rise from the inferior side of the neck of the scapula, and are inserted into the os hyoides near the insertions of the sterno-hyoidei. They direct the movements of the os hyoides, and draw it downwards; one being cut, this bone loses its natural direction and inclines to the other side.

"If we search deeper, we find the stylo-hyoidei muscles, otherwise the *constrictores medii pharyngis*, (B) of which there are three pairs (C). One pair, which is stronger

(B) Either the stylo-hyoidei or these constrictors are wanting.

(C) In the common toad (*Rana Bufo*), and in the *Rana variabilis*, I only found two pairs.

Phyſiology. ſtronger than the reſt, riſes from the poſterior region of the ear, and is inſerted into the points of the cornua of the os hyoides. The other two pairs have the ſame origin, and are likewiſe inſerted into the cornua of the ſame bone, but more forward. Theſe muſcles are likewiſe of great moment in contracting the cavity of the throat, by elevating the os hyoides, and drawing it forward. I have obſerved ſome muſcular fibres in the vicinity of the ſtylo-hyoidei, upon the membrane which lies immediately under the muſcles now deſcribed, and which forms the interior part of the throat: theſe may aſſiſt likewiſe as conſtrictors.

"If we take away the muſcles and the membrane of the throat, leaving only the ſterno-hyoidei muſcles, although reſpiration is now totally deſtroyed, the motions uſed in reſpiration continue. The os hyoides is ſtill drawn backwards and forwards, and the glottis opens and ſhuts, but the lungs remain collapſed; if even all the muſcles which move the os hyoides, are cut away, the glottis, whoſe muſcles remain untouched, continues to open and ſhut, juſt as in hot-blooded animals, whoſe reſpiration is deſtroyed by a large wound in the thorax, efforts to reſpire continue, though ineffectual, to remove the painful ſenſation of incipient ſuffocation.

"On expiration little is to be ſaid; I have always found the lungs of theſe animals, whether alive or dead, to collapſe as ſoon as the glottis is open; yet, as I have already obſerved, the oblique muſcles, which extend from the glottis to the os pubis, and thus envelope the lungs through their whole extent, have a great power to compreſs them, and thus produce expiration. Whether I have properly applied the name of obliques to theſe muſcles I will not contend, as I have not examined them with particular care; they may probably be compoſed of ſeveral muſcles, but thus much I have obſerved that their fibres run more or leſs tranſverſely, and are therefore well adapted to produce this effect *."

* *Tract. on Nat Hiſt.* p. 17.

Propagation of Reptiles.—Although reptiles, from their ſenſes being leſs acute than thoſe of other animals, ſeem in general dull and ſtupid; on the return of ſpring, they exhibit a very different character. As the warm ſeaſon advances, they become lively and active, and thus ſhew that they are actuated by a new ſet of deſires. It is at this time that the frog tribe, which at no other ſeaſon of the year emits the ſmalleſt ſound, become remarkable for the croaking and diſagreeable noiſe, by means of which they expreſs theſe new or once dormant feelings. When theſe feelings acquire force, even ſome of the external parts of ſome of the frog tribe undergo a change. The fore feet of the male are then furniſhed with a kind of wart, which is ſupplied with papillæ, that it may more firmly attach itſelf to the female. The male then places itſelf on the back of the female, and embraces her ſo ſtrongly with the fore feet, that it can only be ſeparated by a conſiderable force. In this ſituation the two remain together for about a month. About the end of this time, or ſooner or later, according to the temperature of the ſeaſon, the female begins to exclude the ova. The eggs form a kind of ſtring, and are united together by a viſcid matter, and included in a thick glairy ſubſtance. At the moment that the ova are excluded by the female, the male ejects a fluid with which they are impregnated, at the ſame time giving a peculiar cry during the courſe of this proceſs. So ſtrongly is the male attached to the female, that nothing can diſturb or interrupt his operations. Nay, what will appear ſtill more ſurpriſing, in an experiment by Spallanzani, in which the head of a male frog was cut off in this ſituation, the animal continued for ſome time to impregnate the ova as they were excluded, and died only at the end of four hours.

Change on the male frog.

When the ovum of the frog is examined with the microſcope, a ſmall point is diſtinguiſhed, black on the one ſide and white on the other, placed in the centre of a globule, whoſe glutinous and tranſparent ſubſtance is ſurrounded with two concentric membranes, which are analogous to the ſhell of the egg. At the end of a certain time, which is longer or ſhorter, according to the temperature of the ſeaſon, the embryo begins to be developed, and is afterwards known by the name of tadpole. Spallanzani has obſerved, that the proceſs of incubation or hatching in the ova of the toad goes on, although the temperature of the atmoſphere does not exceed 6° above zero of Reaumur's thermometer, which is equal to about 39° of Fahrenheit.

Ova of the frog.

It is unneceſſary to mention, that the ova of the frog are depoſited and hatched in water. It may be obſerved alſo that this proceſs is interrupted in the ova of the toad, which happen to be dropt on the earth, unleſs they are ſupplied with moiſture.

The tadpole, as the proceſs of incubation proceeds, and the organs which are deſtined to perform the functions of life are developed, exhauſts the glutinous matter with which it is ſurrounded; this gradually dilates; and the more it increaſes in volume, the leſs is the quantity of its maſs. It becomes at length only a light and almoſt inviſible ſubſtance, from which the tadpole makes a ſhort occaſional excurſion in the water, in making its firſt efforts in ſwimming; but returns again, finding itſelf either unable to procure its food, or to ſupport itſelf long in the water on account of the ſhortneſs of the fins, which have not yet attained their full ſize. But as the little animal advances in its growth, the glutinous matter, its former habitation, being entirely diſſipated, it roams at large in the waters.

Progreſs of the tadpole.

According to the obſervations of Swammerdam, a tadpole is about ſix lines in length at the end of 15 days after it has been depoſited by the female. The firſt traces of the hind feet may then be ſeen; and the place of the toes is marked with ſo many ſmall protuberances. In this ſtage of its progreſs the little animal exhibits a very different appearance from that which it aſſumes after the change it is to undergo. The mouth is not placed at the anterior part of the head, but on the lower ſurface; and when it wiſhes to ſeize any object for its prey, or to expel the air from its lungs by expiration, its motion in turning its body is ſo rapid and inſtantaneous, that the eye can ſcarcely follow it.

In a tadpole of 36 days old the hind legs are protruded; but the fore legs are ſome days later, ſo that to ſee them at the ſame period the animal muſt be opened, at leaſt the external covering which veils in ſome meaſure, or diſguiſes its future form. At laſt, at the end of about two months of confinement, which is about the middle of June, the young frog having reached its perfect form, and acquired ſufficient ſtrength, burſts from its priſon. It contrives at firſt to contract its

Phyſiology. covering by elevating its back; by this the ſkin is torn near the head of the animal, which paſſes through the opening. That part of the membrane which formed the mouth of the tadpole is retracted over the body; the fore-legs are ſucceſſively unfolded; and the ſkin puſhed to the poſterior extremity of the body, leaves the whole of it, as well as the hind-legs and the tail, uncovered. The tail then gradually diminiſhing in volume, at laſt entirely diſappears, ſo that the ſmalleſt trace of it no longer remains in the perfect animal.

Time of the turtle breeding varies.

According to the ſituation of the countries in which they are found, the temperature of the climate, and the period and duration of the rainy ſeaſons in tropical regions, the time of the turtle depoſiting its eggs is regulated. At this ſeaſon the female quits the ocean, and often, it is ſaid, makes a voyage of 300 leagues to find a ſafe and convenient ſpot for the reception of the embryons of her future offſpring. The male, according to the accounts of ſome naturaliſts, accompanies the female in this expedition, with the view of reconducting her to their former haunts. We are informed that they arrive in ſuch multitudes on the banks of the Oroonoko about the beginning of March, that there is not ſufficient ſpace on the ſhore to contain them, ſo that vaſt numbers are ſeen with their heads above water, waiting the departure of thoſe on land, that they may occupy their place. When the turtle has reached the ſhore, ſhe fixes on a ſpot covered with ſand or gravel; digs with her fins, in a place beyond the reach of the tide, one or more holes of about a foot broad and two feet deep; and there depoſits her eggs to the number of more than a hundred. She then covers them with a little ſand, but ſo lightly, that the action of the rays of the ſun may not be interrupted hatching them. The turtle depoſits her eggs commonly at three different times, a period of fourteen days intervening between each time. The dangers to which theſe animals are expoſed, when the light of day favours the purſuit of their enemies, and perhaps alſo, it has been conjectured, the fear of ſuffering from the burning rays of the ſun, make them almoſt always prefer the darkneſs and temperate coolneſs of night to come on ſhore for this purpoſe.

The period of hatching is longer or ſhorter according to the temperature of the climate. In more temperate regions, it continues about 20 or 25 days. At the iſland of St Vincent, (one of the Cape de Verd iſlands), this proceſs is completed in 17 days; and Gumilla the hiſtorian of the river Oroonoko aſſerts, that three days only are required for hatching on the banks of this river. He placed, he ſays, a ſtick near the place where the turtle depoſited her eggs, and at the end of three days, ſo great is the influence of the ſun upon the ſand, the ſmall turtles had made their appearance.

Travellers who have had opportunities of obſerving the ſmall turtles ſoon after they are hatched, when they are only about an inch long, inform us, that in this ſtate they do not quit their holes during the day, being inſtinctively warned to protect themſelves in this manner from the heat of the ſun, and the voracity of birds of prey, but they wait till night to make their way to the ocean. "I have been often aſtoniſhed, (ſays Gumilla,) when I have obſerved that the place where they have been hatched, being ſometimes half a league diſtant from the river, they direct their courſe towards it without any deviation by the ſhorteſt poſſible way. I have ſometimes carried the young turtle to a great diſtance from the water. I have covered them up and made ſeveral holes for them that they might wander. But I no ſooner left them at liberty, than they took the direct courſe to the river, without turning either to the right hand or to the left." The inſtinct with which theſe little animals are impreſſed, conducts them towards the neareſt waters, where they find ſafety and proper food. They move on very ſlowly, and as yet too feeble to reſiſt the force of the waves, great numbers are thrown back by the ſurge on the ſea ſhore, where ſea fowl, crocodiles, tigers, and other animals are in waiting to devour them, ſo that but a ſmall number eſcapes the numerous dangers to which they are conſtantly expoſed. Phyſiology.

Of the alligator.

It is alſo at the return of the ſpring ſeaſon that the alligator depoſits its eggs. It lays about 100 in the ſpace of one or two days; and in the ſame way as the turtle, covers them with ſand, and it is ſaid, rolls itſelf round the place, that it may be the better concealed from its enemies. Having thus ſecured its future offſpring, it returns to the water, when the proceſs of hatching goes on by the heat of the ſun. About the time that the neceſſary period has elapſed for the evolution of the young animal, it is ſaid that the female returns, accompanied by the male, ſcrapes up the ſand, and uncovering the eggs, breaks the ſhell, to allow the young animal to eſcape. It is ſaid that the young alligator, before it leaves the eggs, is at leaſt ſix inches long, and that it is rolled up, having its head placed in the centre. When the ſhell is broken with a ſtick, they bite it furiouſly, and ſink their teeth in this ſubſtance. This ſeems not improbable, ſince it is recorded by different naturaliſts, that the teeth of the young alligator are completely formed before it leaves the egg.

The mode of propagation, ſo far as it has been obſerved among the tribe of lizards, is ſimilar to that of the frog. The male remains for ſome time on the back of the female, embracing her cloſely. This does not prevent them from running about, or leaping from branch to branch. When the female is about to depoſit her eggs, ſhe makes a hole in the earth, of about two inches deep, at the foot of a tree or a wall; in that the egg is dropped and covered with the earth, and, as in the other tribes, the proceſs of incubation is accompliſhed by the heat of the ſun.

But ſome ſpecies of lizards are viviparous. This is conſidered by naturaliſts as exactly the ſame mode of propagation as in the others which are produced from eggs, with this difference only, that the proceſs of incubation goes on in the former within the body of the female, and the young are excluded completely formed.

Size of the eggs.

The Eggs of Reptiles.—The ſize of the eggs of this order of animals is always proportioned to that of the female by whom they are produced. From the ſmalleſt ſpecies of lizard to the huge crocodile, they may be found of every ſize. The ſmalleſt are ſcarcely more than two lines in diameter, while the largeſt are three inches long.

The covering of theſe eggs is different in the different tribes. In the greateſt number, but eſpecially in the eggs of the turtle, it is flexible, ſoft, and ſimilar to moiſtened parchment. The eggs of the crocodile, and of ſome large lizards, are covered with a ſhell of a hard, calcareous

Physiology. calcareous ſubſtance, like that of the eggs of birds. It is however, conſiderably thicker, and conſequently leſs brittle.

Uſed as food. In India and America, theſe eggs are very much ſought after, and are eſteemed by the natives a very rich and delicate food. About the time that the turtle depoſits its eggs on the banks of the Oroonoko, the neighbouring inhabitants repair to the banks of that river with their families, for the purpoſe of collecting them; and they not only live upon them at this time of the year, but dry them, that they may carry them home to be laid up in ſtore for their future ſuſtenance.

It is ſaid that the Indians are extremely fond of the eggs of the alligator, which they ſearch out with great induſtry, and rejoice when they diſcover the place where they have been depoſited. They bake them when they prepare them for food, and although the young animal has begun to be evolved, or is nearly formed, they are not leſs ſcrupulous in eating them.

Food of Reptiles.—It is only in extraordinary caſes that reptiles abſtain from food for any length of time. When they are at perfect liberty, and find that kind of food which is ſuited to their nature, they in general indulge in it voraciouſly. Frogs and lizards feed on leeches, worms, ſnails, beetles, and different ſpecies of winged inſects. Some of the toads live on aquatic plants; the turtles find in the water or on the land, vegetables and ſhell-fiſh; the crocodile is carnivorous, and devours, greedily, fiſhes, ſea-fowl, and turtles; and when preſſed by hunger, attacks men, but eſpecially, it is ſaid, the negro race, whom he prefers to others. This latter fact has probably no foundation whatever. The very largeſt crocodiles, which are more eaſily ſeen and avoided, it is ſaid, employ ſome artifice in ſeizing their prey. They watch about the margin of ſtagnant waters, and lie there covered with mud, like a fallen tree, remain immoveable, and patiently wait the favourable moment to ſeize ſome unſuſpecting animal. Sometimes when they ſwim down any large river, they ſtop at the moſt frequented places, and raiſe only the upper part of their head above the ſurface of the water. In this attitude, which leaves the eyes at liberty, they ſurpriſe the animals which come to cool themſelves, or to drink in the river. As ſoon as they perceive any one, they plunge under the water, ſwim towards it, and ſeize it by the limbs, drag it along to drown it, and afterwards make it their prey.

Reptiles feed voraciouſly.

Abode of Reptiles.—Reptiles, like plants, are profuſely diſtributed over the whole ſurface of the globe; but from their nature and habits are more abundant and numerous in ſome places than in others. Some tribes live entirely on dry land, while others are confined to the bottom of the water. Others may be conſidered as intermediate tribes, living on the confines of the two elements, exhibiting in them the degrees and ſhades of different habits, which reſult from the diverſity of forms. Among thoſe which have their abode on dry land, as many of the tortoiſes, moſt of the lizards, the chameleons, ſome prefer dry and elevated ſituations, while others dwell in caverns or in the holes of rocks; and as theſe are different in their economy and habits, ſo we find that they are different in their motions; while the one is ſluggiſh and inactive, moving ſlowly, the others ſpring or creep rapidly among the branches of trees. Almoſt all of them, however, take the water, and ſwim with great facility; but they are obliged, as well as the reptiles which remain conſtantly in the water, to come to the ſurface from time to time to reſpire the air of the atmoſphere. The intermediate tribes, or ſuch as have their uſual haunts on the limits of the land and water, can only exiſt in climates which correſpond to their temperament. And thus they are found in innumerable multitudes in the immenſe extent of moraſs in the deluged ſavannahs of the new continent, where the moiſture of the atmoſphere and the temperature of the climate are favourable to their reproduction.

Different character of reptiles in different ſituations.

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In Kamtſchatka, where the cold of winter is ſo rigorous, no ſpecies of toad, of frog, or even of ſerpent, is ever ſeen. Lizards, however, are very numerous, which are regarded by the inhabitants with a ſuperſtitious horror. They ſuppoſe that they are ſent by ſome evil deity, as ſpies on their actions, or to predict their death; and hence it is that they uſe every precaution to ſecure themſelves againſt their miſchievous effects. Wherever they find them they cut them to pieces, that they may not be able to return to the malignant being by whom they have been ſent, to witneſs againſt them. Should the animal accidentally make its eſcape, they are ſeized with the moſt violent grief and deſpair. They expect every moment the approach of death, and ſometimes bring on, by their fears and terror, what they ſo much dread. All this contributes ſtill more to increaſe and ſtrengthen this ridiculous and groundleſs ſuperſtition.

Reproductive Power of Reptiles.—Many of the animals belonging to the order of reptiles undergo very conſiderable changes, in the reproduction of different parts of the body, either in the ordinary proceſſes of nature, or when they are deprived of them by accident. The caſting of the ſkin, and its reproduction in different reptiles, as in the toad and newt, may be regarded as a natural operation, in ſome way neceſſary to the economy of theſe animals. It is obſerved, that the water-newts frequently caſt their ſkins; and theſe are occaſionally ſeen floating in the waters which they inhabit. The ſkin is ſometimes ſo perfect, that it exhibits the whole form of the complete animal.

The following account of this proceſs by Bonnet will, we doubt not, be intereſting to the reader.

Caſting the ſkin.

"When, ſays he, the period of change approaches, the fine ſkin is obſerved detaching from the body. The head firſt loſes it; then the reſt of the anterior part; next the middle, and the poſterior part. Sometimes the ſpoil, caſt by the head, forms like a gauze collar or cravat around the neck; or it is adjuſted on the head, like a capuchin or head-dreſs.

"The commencement of ſeparation, from the back and belly, is diſcovered by viewing the newt obliquely from one ſide, in a ſtrong light. The ſkin of the belly is further detached, becauſe it falls down by its own weight.

"Approaching ſpoliation is recognized by conſpicuous and unequivocal ſymptoms. The back, viewed obliquely, appears whitiſh, and as if covered with a ſpider's web. This is the effect of the ſpoil beginning to ſeparate. If cloſely examined with the naked eye, or a magnifier of ſmall power, it ſeems compoſed of minute ſcales covering the calloſities or tubercles, which ſhagreen the body of the newt. But, when examined

Physiology. with more attention, and in a favourable light, this epidermis is discovered to be a beautiful reticulation, the meshes of which are visible to the naked eye.

"Many observations could be made on the texture of this delicate membrane; and these might greatly tend to elucidate the nature and origin of the epidermis, which, notwithstanding all the researches of physiologists, are so little known; and newts would afford frequent opportunities for deeply investigating the point.

"From particular attention to the newts in my possession, I have observed, that there is not the smallest resemblance between this operation and what is exhibited by caterpillars, and many other insects. The skin is detached here and there, and often in different sized plates; and the change is slow, for it occupies one or two days, and I have even known it take three. During spoliation, the newt continues moving about in the water, with all the usual motions of newts that undergo none; therefore it is no disease, and it does not affect them as it does insects. While the change is going on, the animal darts on its prey, holds and devours it.

"Sometimes spoliation is difficult to be accomplished; but, in these cases, the newt knows to practise certain manœuvres, to facilitate the operation, which I have often beheld with pleasure. It alternately raises and depresses the right arm and left leg at the same time, with gentle vibrations of the whole body. It frequently darts suddenly towards the surface of the water, and the next moment precipitates itself to the bottom; and these manœuvres I have seen continued above half an hour. But the sudden exertion, in all its motions, indicated that the newt was impatient at the tediousness of the change.

"When most of the spoil is thrown off, and the animal, to disengage itself from the rest, rapidly rises to the surface, it seems carried along in a cloud; for the whiteness, fineness, and semitransparency of the spoil, floating around it, is no imperfect representation of a cloud.

"I never observed the fingers employed in detaching the spoil. Both young newts and those full grown cast several successive skins: some of large size are in my possession, that have done so before me. Reproducing limbs throw off the epidermis as well as the original.

"I have seen the skin of the head, which formed like a collar or cravat round the neck, gradually come down the belly of a large newt that had lost the arms, and fasten like a tight girdle.

"Nothing can accurately be said of the number and interval of mutations. Between the 14th of July and the 7th of September, a newt has changed its skin 11 times.

1st change,	14th July.	6th change,	9th August.
2d	17th	7th	—
3d	20th	8th	19th
4th	24th	9th	24th
5th	30th	10th	26th
		11th	6th Sept.

"Spoliation sometimes makes a slight change in the colour."*

The manner in which toads throw off the old cuticle is quoted by Dr Shaw, as related by Mr Schneider, from Grignon, who was an eye witness of it. "The skin splits or cracks in a longitudinal direction, both above and below, and the animal pulls off that of the left side with its left foot, and, delivering it into the right foot, applies it to its mouth and swallows it. It then performs the same process on the right side, and, delivering the cuticle into the left foot, swallows it like the former." Physiology.

But the most remarkable circumstance in the economy of these animals is the reproduction of mutilated limbs, such as the legs, the tail, and even the eyes. The completest set of experiments to ascertain these curious facts, were made by Spallanzani and Bonnet. The following is an account of some of these experiments in the words of the author.

"EXPERIMENT. *The right arm and left leg of a newt amputated.*—On the 6th of June, I cut the right arm and left leg off a large newt, very near the body. A stream of florid blood spouted a minute and a half from each wound; however, the vessels soon closed, and the newt was apparently as well as those unmutilated. But it will easily occur that it did not swim with equal facility.

"When about a month had elapsed, I began to perceive a papilla, of a violet gray colour, near the edge of the trunk or section. This was the origin of a new arm and leg, which gradually increased; and, from the 14th of July, the two papillæ continued growing on the subsequent days, but more in length than thickness. They became minute stumps; and, on the first of August, were about two lines long. A kind of cleft, hardly perceptible, announces the appearance of two toes, which nature labours to produce, or rather to expand, on the new foot. No cleft appears on the originating arm.

"The two toes were easily recognised on the 7th. They were real miniatures, and truly most minute. The stump of the arm continued nearly as it was on the first of the month, but is now somewhat larger; but as yet there is no indication of fingers.

"It is pleasing to observe the little hand fully unfolding, while only three fingers of unequal length are visible: the middle one is the longest. The arm has made no sensible progress. The new foot had four toes also of unequal length, the first and second of which are longest; other two only begin to appear; the fourth is scarcely perceptible. One can never tire contemplating these miniatures, and admiring the wonders of the organic kingdom.

"Evolution advanced every day. On the 22d of August, the regenerated members began to deepen in colour, so that the line, discriminating the old parts from the new, was no longer so conspicuous; but the black specks on the toes of unmutilated newts were still imperceptible. Leg and arm reproduced.

"I continued my observations on the daily evolution of the members; and the following were their dimensions in length, on the 20th of September.

Old Members.		*New Members.*	
Arm,	4 lines.	Arm,	$2\frac{1}{2}$
Cubit,	$3\frac{1}{2}$	Cubit,	$2\frac{1}{2}$
Thigh,	3	Thigh,	$2\frac{3}{4}$
		Leg,	

* *Spallanzani's Tracts*, ii. 365. *Dalyell's Trav.*

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Leg,	4	Leg,	$2\frac{1}{2}$
Longeſt finger,	$3\frac{1}{2}$	Longeſt finger,	$1\frac{1}{2}$
Longeſt toe,	$4\frac{1}{2}$	Longeſt toe,	$1\frac{1}{2}$

Even in the beginning of October, the fifth toe of the new foot was not viſible.

" EXPERIMENT.—*A newt deprived of the right arm and left hand.* On the 12th of June, I cut the left hand and right arm off a newt: my chief object in this experiment was to verify Sig. Spallanzani's aſſertion, that nature reproduces exactly the portion amputated, which was a fact of the utmoſt importance in the theory of animal reproductions, and could not be too well eſtabliſhed.

" Towards one ſide of the ſection, a little conical nipple began to appear about the 7th or 8th of July, of a violet gray colour. An incipient cleft, indiſtinctly ſeen with the naked eye, was perceptible near the middle of July: the papilla ſeemed ready to divide in two; and the cleft was the origin of two fingers.

" In two or three days, I remarked a new cleft at the upper extremity of the papilla, which was the beginning of a new finger: the third, in its turn, appeared on the 19th. The conical papilla had then diſappeared; and in its place was ſeen a ſmall open hand with four fingers, ſtill very minute, but quite well ſhaped.

" On the 3d of Auguſt, the cone began to divide, that is, two fingers became evident.

" On the 9th, a hand extremely minute, but the moſt beautiful object imaginable, was obſerved at the extremity of the arm. The fingers, all of unequal length, were diſtinguiſhed, the ſmalleſt being juſt perceptible. The trunk, or part of the original arm, connected to the body, may be recogniſed by the brown colour, and from being covered with white points. The new arm is of a lighter and uniform colour. Four fingers of the hand are viſible: the largeſt not above half a line in length.

" The hand of the left arm had made conſiderable progreſs on the 21ſt: it had expanded, and nearly acquired the figure peculiar to the newt's hand. The fingers alſo had extended, and become thicker in proportion. The whole hand began to colour, and brown ſpecks were diſtinguiſhable on different parts; they were more evident on the back of the hand than on the fingers.

" On the 21ſt, the hand has already aſſumed its natural ſhape, and the rapid progreſs of evolution is ſuſpended. Colouring of the arm begins near the trunk: but all the reſt is of a mixed gray and violet colour.

" Though I have not hitherto expreſsly ſaid ſo, it will obviouſly be preſumed, that there is a kind of ſemi-tranſparency in the reproduced parts, which the original members have not. This continues long, and changes ſlowly as the reproductions colour. The tranſparency is evidently greater on the edges of the fingers than elſewhere; if examined with a magnifier, they ſeem incloſed in a fine diaphanous envelope: but nothing of this is evident in the old fingers. Parts beginning to unfold naturally have a degree of tranſparency wanting in thoſe further advanced, or fully expanded, becauſe, with the progreſs of evolution, the calibre of the veſſels increaſes, which allows admiſſion to more groſs and colouring particles. Whiteneſs and tranſparence apparently conſtitute the primitive ſtate of organic bodies. It is this primitive ſtate which we deſign by the word *germ*; and which we can comprehend, when the organic whole is expanded to a certain extent. But there is here a term beyond which we cannot aſcend; for the organic whole either becomes ſo minute or ſo tranſparent, that it eſcapes all reſearch and our moſt perfect inſtruments. Physiology.

" The dimenſions of the old and new members, in length, were as follows, on the 2d of September.

Old Members.		*New Members.*	
Arm,	$3\frac{1}{2}$ lines	Arm,	$2\frac{1}{2}$
Cubit,	$3\frac{1}{2}$	Cubit,	$2\frac{1}{2}$
Longeſt finger,	$1\frac{1}{2}$	Longeſt finger,	$1\frac{1}{2}$

Ibid. ii. 372.

" EXPERIMENT.—*The tail of a newt amputated tranſverſely.* Something important would have been wanting, had I neglected amputation of the tail, which is a very intricate great organic ſubſtance. It is formed of a ſeries of minute vertebræ, with arteries, veins, and nerves; and it is covered with muſcles and fleſh.

" The tail of a large newt is more than two inches long, and about half an inch thick, formed like an oar, and terminated by a ſoft point. Much might be ſaid of the figure, proportions, and poſition of this organ, and with reſpect to the functions it has to exerciſe; but theſe would be details foreign to any purpoſe: I only mean to confirm what Sig. Spallanzani has advanced concerning the admirable reproduction of the members.

" When the tails of large newts were amputated near the origin, I never ſucceeded in obtaining reproduction; the whole died in a certain time; and for ſeveral weeks preceding death, a kind of whitiſh cotton mould grew on the wounds, the filaments of which were ſeveral lines in length. Nevertheleſs, I cannot think that this affected the animal's life, for I had ſeen ſimilar mould, or cottony filaments, on wounds occaſioned by amputating the arms and legs. Theſe filaments gradually diſappeared, and unequivocal ſigns of reproduction ſoon became viſible. Thus a good obſervation was never obtained, unleſs the tail was divided about the middle, and by a ſection perpendicular to the axis. A ſtream of blood, as thick as a hog's briſtle, always ſpouted from the wound. The large veſſel, from which it flows, is ſituated near the vertebræ, and its orifice is viſible by the naked eye; it immediately cloſes; and the orifice is diſtinguiſhed by a reddiſh or browniſh point.

" The tail of newts is very ſenſible, which is particularly evident in the ſlendereſt part. A portion cut off will retain life, and move whole hours; and when life ſeems entirely extinct, we have only to prick the pointed extremity, that motion may be renewed; it riſes and falls alternately, and with greater force, according to the period that has elapſed ſince the operation. The motion of this ſeparated part bears great reſemblance to that which is peculiar to certain apodal worms; it is undulatory, and evidently depends on irritability, which is extremely active in ſo muſcular an organ.

" Immediately after the operation, the area of the cut exhibits a very long ellipſe; the two extremities almoſt terminating in a point. The ſmalleſt diameter is about a line acroſs, and the largeſt five or ſix. In the centre are the vertebræ, or blood-veſſels; the reſt of the area ſeems full of ſmall oblong clear white ſubſtances,

Physiology. ſtances, which one would ſuppoſe pieces of fat, or glands. The ſurface ſlowly contracts; the oppoſite ſides approach; the colour of the ſubſtances becomes fainter, and in a certain time, which is according to the ſeaſon, new fleſh appears, and it daily increaſes. Then we obſerve one or two croſs brown lines, occupying the middle of the new tail, which indicate the ſite of the vertebræ and the veſſels. In a tail which had been divided on the 11th of July; on the 14th of Auguſt the reproduced part was about three lines and a half long, and four and half in diameter, at the baſe.

Tail regenerated. "The new portion was ten lines in length, 20th September, and ſhaped exactly like the tail of a newt. I could obſerve no difference between the motions of this regenerated tail, and thoſe of tails unmutilated. Thoſe of the regenerated part only had a peculiar tranſparency, wanting in the reſt of the tail.*

* *Ibid.* ii. 381.

"EXPERIMENT.—*Whether reproduced members poſſeſs the ſame ſources of reproduction as thoſe amputated.* I cut the left arm and right thigh off a large newt, 2d June 1778. In the beginning of July, a new arm and thigh began to reproduce. They were ſtill in miniature, but the fingers and toes ſufficiently formed, and very diſtinct.

"On the 11th of July, I made an experiment, which was moſt important in the theory of animal reproductions. The object was to diſcover whether the members now reproducing, which in reality were miniatures, contained the ſame ſources of reparation as the original; that is, whether they were, in new limbs, germs containing members in miniature, ſimilar to thoſe amputated. With this view, I cut off the regenerated hand and foot.

"At the extremity of the reproduced leg, on the 21ſt, appeared two new toes extremely minute, but eaſily recogniſable by the naked eye: and, on the 24th, an originating hand, with three well-ſhaped fingers, appeared at the extremity of the new arm.

"The foot, now reproduced, exhibited four very diſtinct toes. Both theſe and the fingers were yet only one fourth, or one-third, of a line long.

"Therefore it is proved, by this firſt experiment, that the reproduced limbs of a newt can make new productions, in the ſame manner as the old ones can, and give birth to members which, in their eſſential parts reſemble thoſe amputated, and are different only in ſize, conſiſtence, and colour: for, as was remarked in my former memoir, the new members are of more delicate texture, and of a much lighter colour than the old.

"It was undoubtedly moſt intereſting to aſcertain how far the reſources of nature extended; and whether, after ſeveral ſucceſſive mutilations of the reproduced member, a new one would ſtill regenerate.

"On the 31ſt of July, for the ſecond time, I cut off the reproduced hand and foot of my newt; the fingers and toes being then about a line long.

"Two new fingers and toes appeared at the extremity of the limbs, 13th Auguſt, therefore a hand and foot had begun to regenerate. On the 15th, there were three fingers and toes already well formed, though very ſmall.

Reproduced members alſo regenerated "Both the hand and foot ſeemed quite repaired on the 24th, though ſtill of extreme minuteneſs. All the fingers had grown, but only four toes. And it may now be obſerved, that the appearance of the fifth toe is conſtantly later; often it does not unfold.

"On the ſame day, 24th Auguſt, I amputated the reproduced hand and arm the third time; and on the 13th October, performed the fourth operation: the limbs being then in the ſame ſtate as thoſe mutilated by the third amputation. Physiology.

"Thus it is fully eſtabliſhed, that every member, ſucceſſively reproduced, contains new ſources of reparation; and that they are actually exiſting, though the member is extremely minute.

"From theſe ſucceſſive mutilations of reproduced members, I have thought the extremity of the leg and arm became a little thicker than uſual, as if from a reflux of the nutritive fluids into the extremity, by ſuch repeated amputations.

"This ſeaſon was particularly favourable to my experiments, being always dry and warm. A mercurial thermometer, in the ſhade, completely iſolated, on a large terrace, ſtood at 90° and 93°, on the 14th and 15th of Auguſt. Moſt of ſummer it ſtood between 79° and 81°; and the temperature of the apartment, where the newt was kept, differed very little from that of the open air.

"EXPERIMENT.—When a large newt was treated as has juſt been related, I made another experiment on one of ſimilar ſize, to obtain comparative reſults.

"The left arm and thigh were ſevered 2d June 1778. Reproduction of new members commenced in the beginning of July: two well ſhaped toes were then on the foot. On the 11th, new limbs had replaced the old; they ſeemed completely repaired: ſtill they were only miniatures of moſt delicate texture. This day I amputated the reproduced hand and foot.

"A new foot, with two diſtinct toes, was perceptible on the 22d; and three were viſible on the 24th. But the new hand had not appeared; at leaſt there was no evidence of originating fingers. The thermometer now ſtood about 84°. However, a new hand, with three perfect fingers, was ſeen on the 29th.

"The reproduced hand and foot being a full line long on the 31ſt, I then cut them off. Both appeared again, Auguſt 15th, with three well ſhaped fingers and toes. On the 24th, the hand had acquired its four fingers, and the foot five toes, all viſible, though exceſſively ſmall.

"I then cut off the hand and foot for the third time. The fingers and toes were a full line long 13th October; four of each appeared, but the fifth toe was yet imperceptible.

"Next I performed a fourth amputation: it alſo was followed by reproductions. Various occupations having interrupted me, a fifth amputation was not made before 26th Auguſt 1779.

"The longeſt finger was then about one line and a third, the longeſt toe one and a half in length, deep coloured, and very ſlender. The hand had four fingers; the firſt and fourth imperfect. The foot had only three toes, more diſtant from each other than uſual. Both the fingers were as imperfect 30th October 1780: the fourth ſcarcely viſible, and conſiſting only of a ſharp point; and no more than three toes on the foot. The newt had then diminiſhed greatly in ſize, and was very brown. It ate little, and ſeldom: it remained long at the ſurface, unable to get to the bottom of the water; and its belly was almoſt always very much inflated.

"Theſe are two experiments, therefore, which concur

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in eſtabliſhing the ſame fact, viz. that the reproduced members of a newt, though ſtill in miniature, are equally provided with reparatory germs as the old limbs; and that they begin to unfold after the new members are cut off."*

* *Ib.* ii. 394.

To theſe curious experiments we ſhall only add the account of another, concerning the reproduction of the eyes of newts.

"EXPERIMENT.—*On the eyes of newts.* This is a cruel experiment; and ſenſible minds will hardly pardon the obſerver's cruelty, though it ariſes from an evident deſire to diſcover new facts and enlarge our knowledge of the animal economy. Therefore, I fear the compaſſionate reader will revolt further ſtill at what is yet to be related. But I beg he will conſider, that animals, which, after loſing one, or even ſeveral limbs, continue greedily devouring the prey preſented, undoubtedly cannot experience the ſenſation of pain to the exceſs which our own ſenſations lead us to imagine. We are very inſufficient judges of what paſſes within an animal ſo remote from us in the ſcale of living beings. Let it not be thought, that by theſe reflections, I mean to leſſen the natural repugnance of every humane mind to make animals ſuffer. The benignity of nature itſelf will inſpire man with this precious ſentiment to prevent the enormous abuſe that his power might exert over the animals which ſhe has ſubjected to his dominion. Yet let me aſk, whether a rational perſon abuſes his empire over animals, by making them ſuffer only for his own inſtruction, or that of his fellow creatures.

"With a ſcalpel, I extracted the right eye of a large newt, September 13. 1779; but I did not obtain the globe without much injury to the tunics. It was the firſt time of performing the operation, and before I had acquired the peculiar dexterity neceſſary for ſucceſs, and afterwards learned by experience. Thus the utmoſt diſorder enſued in the eye, and the cryſtalline lens ſtarted out on my nail. This is a beautiful object; no larger than a millet ſeed, and quite tranſparent. I thought that I beheld one of the ſpherical lenſes with which Leeuwenhoeck diſcovered ſo many wonders. But contact of the air ſoon tarniſhed the minute lens; it dried and became diſfigured.

"A deep bloody wound in the ſocket of the eye was the conſequence of this cruel operation. And the reader will not be ſurpriſed if I hardly expected any thing from it, and that the newt would probably remain blind for ever. How great was my aſtoniſhment, therefore, when, on the 31ſt of May 1780, I ſaw a new eye formed by nature. The iris and cornea were already well ſhaped, but the latter wanted its peculiar tranſparency, which is very conſiderable in theſe animals. Impatience to arrive at the moſt important part of the prodigy has induced me to omit the progreſs of it; and obſerve that nature certainly began with cloſing the wound.

Eyes regenerated.

"The eye was completely repaired 1ſt September. The cornea was nearly as tranſparent as that of the other eye, with which it was frequently compared. The iris had alſo acquired the yellow gilded colour, which characteriſes this ſpecies of newt. In ſhort, the eye was ſo perfectly renewed, that no veſtige exiſted of the uncommon operation that the animal had undergone. During the remainder of this and the following month, the cornea always became more tranſparent; and now, when I write theſe remarks, 8th November 1780, it is equally perfect as the other; but the reproduced eye ſeems a little ſmaller than the entire one; and the iris, or golden circle, goes only half round the ball. Physiology.

"It would ſtill be neceſſary to extract the reproduced eye, to aſcertain, by diſſection, whether it contains a cryſtalline lens ſimilar to the original. But I confeſs, that, as yet, I have not had reſolution to ſubject the newt to the moſt barbarous of all operations; and I ſhall probably await its death for ſatisfying my curioſity."*

* *Ibid.* ii. 431.

HYBERNATION OR TORPIDITY OF REPTILES.—The heat of the atmoſphere is neceſſary to animals, that when the periodical return of the ſeaſons reduces the heat of the countries in the neighbourhood of the equator to the cool temperatures of places ſituated in higher latitudes, reptiles loſe their activity; the heat of their blood diminiſhes; their ſtrength decreaſes; they retire into obſcure retreats, in holes of rocks, in the mud at the bottom of lakes, or elſe they ſeek ſhelter among the roots of plants which grow on the banks of rivers: but the cold increaſing, they fall into a ſtate like that of profound ſleep; and this torpor is ſo great, that no noiſe diſturbs or awakens them. They ſeem alike inſenſible to violent blows or ſevere wounds. Reptiles are ſubject to this ſtate of torpidity only in thoſe countries where the variations of temperature at different ſeaſons of the year is conſiderable; and indeed it ſeems to be a wiſe regulation of nature, that ſome of the animals functions ſhould be ſuſpended during that period of the year when the ſupply of food is cut off. This is the caſe with reptiles which inhabit countries diſtant from the equator, whoſe food conſiſting of inſects, worms, &c. can only be obtained in the warmer ſeaſon of the year. Accordingly, about the end of autumn, the reptiles which have been vigorous and active in the ſummer, conceal themſelves in the earth, or under the water, where they remain in the torpid ſtate till the return of the genial warmth of ſpring. In Britain, frogs are found at the bottom of ſtagnant water, or in marſhy places, where the water of ſprings iſſues from the earth, the temperature of which continues uniform through the whole year. Places to which they retire in winter.

In this ſtate of torpor and inaction, nothing of the animal remains but the form, and thoſe functions only go on, which are eſſentially neceſſary to exiſtence during this long period of torpidity, which ſometimes continues more than ſix months. The total maſs of the body of reptiles ſuſtains only ſmall loſs of ſubſtance, but the external parts, ſuch as are expoſed to the action of the cold, and more diſtant from the centre of heat, undergo in the moſt of animals a conſiderable change.

But even in countries where the change of ſeaſons is ſo great, and the diminution of temperature ſuch as to oblige the animals belonging to this order to retire during that ſeaſon, there are in particular circumſtances ſome remarkable exceptions. One of theſe is mentioned by Townſon in his Travels in Hungary. "The town of Gran (he ſays) is favoured with a fine ſpring of tepid water, of more uſe, I believe, to the frogs than to its other inhabitants. My Ciceroni aſſured me that this animal is not torpid here during the winter, but is then ſeen in numbers in the pond in the town which receives its water from this ſpring. This is uncommon (continues the ſame author), but not ſurpriſing. For theſe three

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three years, I have kept a favourite tree frog, which is as gay in winter as in ſummer, provided ſhe has warmth and enough to eat. The German ſtoves, which keep the room warm all night, have been very favourable to her. In this, hybernation differs from ſleep, that, whereas the latter admits of little variation, and can never be laid aſide, or through art receive a ſubſtitute; the former greatly varies, and may be ſupplied by warmth and food. The Alpine marmot, in ſome high vallies in Savoy hybernates, I am told, eight or ten months in the year. In other parts of the Alps, it does not hybernate half that time; and when kept warm, and well fed, its annual ſleep entirely forſakes it, but not its diurnal. The ſame warmth that keeps alive the frog, keeps alive the inſects on which it feeds, which in their turn will find food from the vegetable world, the mediate or immediate ſupport of every living being kept in vegetation by the ſame cauſe *."

Hybernation different from ſleep.

* p. 60.

Abſtinence of the crocodile and the turtle.

ABSTINENCE OF REPTILES.—The ſingular inſtances of abſtinence which have been recorded of many of the animals belonging to this order, are not the leaſt of the peculiarities by which they are diſtinguiſhed. It is conjectured by ſome phyſiologiſts, that the texture of the ſkin, which has few pores, and from which conſequently the waſte by perſpiration is very ſmall, enables them to endure long abſtinence. The turtle and the crocodile can live two months without any kind of nouriſhment. It is no unuſual circumſtance to keep turtle on the decks of ſhips, during a paſſage of ſeven or eight weeks, from the Weſt Indies, without any food whatever, only occaſionally moiſtening the eyes with ſalt water.

Of the toad.

The toad has lived eighteen months entirely deprived of food, and excluded from the air; ſo that the functions of digeſtion and reſpiration, ſo neceſſary and eſſential to animal exiſtence in general, muſt have been totally ſuſpended. We have already mentioned, in the natural hiſtory of the toad, Heriſſant's experiments on this ſubject before the French academy; and it would be ſuperfluous to repeat the account of them here.

In the ſame place we have alſo given our opinion of the extreme improbability of toads, or indeed, it may be added, any animal whatever, having exiſted for any length of time incloſed in wood or ſtone, according to the vague ſtories which have been propagated of ſuch having been diſcovered. The experiments of Heriſſant, above alluded to, afford a direct proof of the contrary.

TENACITY OF LIFE.—Many of the tribes of reptiles are not leſs remarkable for being extremely tenacious of life. They not only live when deprived of their limbs and are otherwiſe mutilated, but abſolutely ſeem to be little injured when ſome of the organs eſſential to life in other animals, and without which they could not exiſt for a moment, have been removed. The experiments of Redi on the land tortoiſe, which we have related in the natural hiſtory of that animal, in p. 271. are a proof of this fact.

AGE OF REPTILES.—Of the age of reptiles not much is known. But, from the few well-authenticated inſtances which are recorded, it may be fairly preſumed, that the period of the life of many tribes is very long. This, indeed, might have been concluded to be the caſe with cold-blooded animals, which can ſuſtain total abſtinence for ſuch a length of time, are ſo extremely tenacious of life, and repair ſo eaſily the loſs of different parts of the body: but, on the other hand, when it is conſidered that they have no fixed haunts where they can remain always undiſturbed, that from their amphibious nature they live alternately on the land and in the water, and that they are conſtantly expoſed to the viciſſitudes of the ſeaſons, it is not poſſible to conceive but theſe changes from wet to dry, and from hot to cold, muſt greatly affect the animal frame, and limit the period of exiſtence.

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But without entering into any train of reaſoning on the ſubject, the facts which have been recorded, and ſome of which we have related, clearly ſhew, that individuals among reptiles arrive at a very great age. The age of the land tortoiſe which was kept in Lambeth gardens, and which we have mentioned in p. 271. was at leaſt 120 years. The common toad, of which the hiſtory of one kept by Mr Aſcot in Devonſhire, that lived to the age of 40 years, is given in p. 286. is an inſtance of the remarkable length of life of ſo ſmall an animal.

Age of the tortoiſe and the toad.

Some ſpecies of the turtle do not reach their full ſize till they are 20 years old; and it is ſaid that they live more than a century.

The turtle.

The age of the crocodile can only be conjectured. It is ſuppoſed that this animal, which does not reach its full ſize of 25 feet long in leſs time than 32 years, may live ſeven times this period, ſo that the age of the crocodile has been calculated at 200 years.

Of the crocodile.

MANNERS, &c. OF REPTILES.—There are probably few animals which diſcover ſo much tranquillity and compoſure in their manners and habits, in general, as reptiles. Leſs agitated within by violent paſſions, and leſs affected from external objects than other animals, they are calm, mild, and peaceable. And if the crocodile, which of all the animals belonging to this order is the moſt voracious and deſtructive, is to be regarded as an exception, the ferocious habits for which he is diſtinguiſhed, are owing to the great ſize of body which he muſt ſupport; and, beſides, how many tribes may be oppoſed to this ſanguinary family, whoſe character is quite the reverſe. Let us only compare the character of the crocodile with the gentle habits of the ſmall gray lizard, or with the manners of the frog.

But notwithſtanding this favourable character of reptiles, which may be conſidered in ſome meaſure as negative, it is to be obſerved, that, in their manners and habits, they never diſcover that choice of means, that ſeries of combinations, or that kind of foreſight, which in many other animals we behold with wonder and admiration. If ſometimes they aſſemble together in great numbers, this by no means exhibits the character of that ſocial union which takes place among gregarious animals, for it diſcovers no foreſight or order. This bond of union is founded on no connection with each other, on providing no means for their mutual ſafety or protection. They produce no common work; they do not join together in ſearch of prey, nor are they united in making any general attack on their enemies. Like the beaver, birds, or bees, they conſtruct no permanent aſylum; but when they fix on any particular place of abode on the ſhores, in the clefts of rocks, or in the hollow of trees, it is not a commodious habitation which they prepare for a certain number of individuals, and which they endeavour to appropriate to different purpoſes,

Phyſiology. purpoſes, it is rather a retreat for concealment on which they make no change, and which they occupy equally, whether it be only ſufficient for a ſingle individual, or contain an extent of ſpace to admit many. If they aſſociate together, it has been obſerved, for the purpoſe of purſuing their prey either on the land or in the water, it is becauſe they are equally attracted by the ſame object; if they make a joint attack, it is becauſe they have the ſame prey in view. If they ſeem to unite for the common defence, it is becauſe they are attacked at the ſame time; and if any individual among them has ever ſaved the whole party, by warning it by its cries, it is not as has been ſaid of monkeys and ſome other quadrupeds, that they have been left to watch for the common ſafety, but only proceeds from the impreſſions of fear which every animal poſſeſſes, and which renders it conſtantly attentive to its own preſervation.

It has been commonly ſuppoſed that reptiles have none of thoſe tender affections, with which the care for the preſervation of their offſpring inſpires other animals. Their whole concern about their progeny, it is thought, extends no farther than depoſiting their eggs in proper places, and covering them with ſand and leaves. The offſpring is not indebted to the parent for its food, for any of its habits, or for aſſiſtance or protection of any kind. It is true, that in general, the moral affections owe much of their force to the repeated impreſſions on the ſenſes, and that theſe impreſſions, recurring diſtinctly to the memory, and modified by the imagination, cheriſh theſe feelings; whence it follows, that the females of reptiles, which do not hatch their young, and which never ſee them till after the proceſs of incubation is completed, muſt have very feeble impreſſions of maternal tenderneſs, or perhaps none at all. The few obſervations, however, which have been made with regard to the attachment of the crocodile to its offſpring, ſhew that ſome of them are not entirely deſtitute of that feeling, which almoſt univerſally pervades the animated creation. "At Surinam (ſays M. de la Borde) the female of the crocodile remains always at a certain diſtance from her eggs, which ſhe watches and protects with a kind of fury when any animal approaches them. On the banks of the Oroonoko, when the alligators are hatched, the mother places them on her back and returns to the river. "But, adds Gumilla, the male eats as many as he can, and the female herſelf devours all thoſe which ſeparate from her, or which are unable to follow her; ſo that ſcarcely five or ſix, of the whole number, remain." This fact, which is by no means probable, even in ſo voracious an animal as the crocodile, is not incompatible with what is certainly known of many other animals devouring their own offſpring. But it ſeems extremely doubtful, that what is mentioned above of the crocodile watching its eggs, as recorded by de la Borde, is an obſervation founded in truth.

Enemies of Reptiles.—The earth would ſoon be covered with immenſe ſwarms of reptiles, if nature had not made ſome proviſion to retard their increaſe, and raiſed up a crowd of enemies which deſtroy their eggs and their offſpring, and preſerve the proper balance which is eſtabliſhed among the different orders of animals. Fortunately, a great number of frogs, toads, lizards, and crocodiles are deſtroyed before they are hatched. Many quadrupeds, as ſeveral ſpecies of monkeys, the ichneumon, and other animals, as well as ſeveral ſpecies of aquatic birds, ſearch for their eggs on the ſhores, and feed on them with avidity. All the ſmall reptiles, which live in the water, which crawl in the mud of marſhes, or creep on the earth, become the prey of fiſhes, of ſerpents, of birds, and of quadrupeds. Phyſiology.

The tiger attacks the crocodile, and is ſometimes ſucceſsful in ſeizing its prey. The hippopotamus is a terrible enemy to the ſame animal; and is the more to be dreaded, as from his habits, he is enabled to purſue it to the bottom of the water. The cougar, although a leſs ferocious animal than the tiger, deſtroys many alligators. He waits in ambuſh on the banks of the great rivers for the approach of the young ones, and at the moment they raiſe their head above the water, he ſeizes them and tears them to pieces. But when he attacks thoſe that are large and vigorous, he often meets with a bold and effectual reſiſtance. It is in vain that he faſtens his talons in their eyes; theſe huge reptiles drag him to the bottom of the water and devour him.

But man is perhaps the moſt dangerous enemy of the crocodile; ſometimes he attacks him by open force, and ſometimes by means of ſtratagem. The Africans, as ſoon as they perceive one of theſe animals on the bank of a river advance towards him, having only in their hand a ſtick of very hard wood, or an iron rod about eight or ten inches long, and well ſharpened at the ends; they hold this feeble inſtrument by the middle, and when the reptile, which advances towards them, opens his wide mouth, they introduce the rod of iron, which they turn with dexterity, ſo that the monſter finds that he is unable to cloſe his jaws. The pain from the wound, and inſtinct to reach a place of ſafety, make him retreat into the water, where he ſoon periſhes by ſuffocation and the loſs of blood. It is ſaid, that ſome negroes are ſo bold and dexterous, as to ſwim under the body of the crocodile, and to pierce him in the ſkin of the belly; which is almoſt the only place on which a wound can be inflicted.

In ſome countries the natives employ ſtratagem to take this dreaded animal. In Egypt, they dig a deep ditch in the path which he follows in proceeding from the river. This is covered with branches of trees, and with a ſmall quantity of earth; they then ſet up loud ſhouts, at which the crocodile is terrified, and returning the ſame way to the water, he paſſes over the ditch, falls into it, and is either killed or taken in ſnares.

The Indians ſucceſsfully employ another mode of deſtroying the crocodile. They introduce into the body of a ſmall animal, newly killed, a quantity of arſenic or quicklime, ſo ſecured, that the moiſture cannot reach it; and this animal is expoſed to the view of the crocodile. This is undoubtedly the moſt certain, and the leaſt dangerous expedient.

EXPLANATION of PLATES.

Plate CCVII.

Fig. 1. Teſtudo Græca, *Common land Tortoiſe*, page 270.
Fig. 2. Teſtudo Mydas, *Green Turtle*, page 278.
Fig. 3. Rana Eſculenta, *Green or Eatable Frog*, page 281.
Fig. 4. Rana Arborea, *Tree Frog*, page 284.
Fig. 5. Rana Pipa, *Surinam Toad*, female, page 288.
Fig. 6. Draco Volans, *Flying Dragon*, page 289.

Plate CCVIII.

Fig. 7. Lacerta Crocodilus, *Common Crocodile*, page 290.
Fig. 8. Lacerta Alligator, *Alligator or American Crocodile*, page 291.
Fig. 9. The Young Alligator proceeding from the egg.
Fig. 10. Lacerta Chamæleon, *Common Chameleon*, page 300.
Fig. 11. Lacerta Salamandra, *Salamander*, page 303.

Plate CCIX.

Fig. 12. Skeleton of the Turtle.
Fig. 13. Skeleton of the Frog.
Fig. 14. Skeleton of the Crocodile.
Fig. 15. Skeleton of the Gray Lizard.
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Fig. 1.

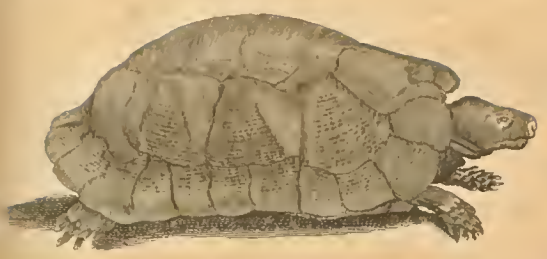

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Fig. 3.

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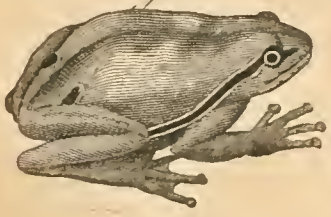

Fig. 5.

Fig. 6.

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Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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Fig. 12.

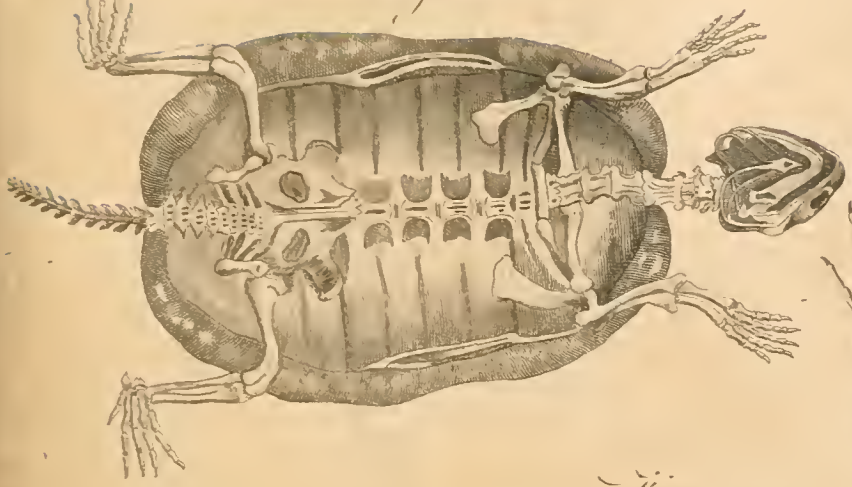
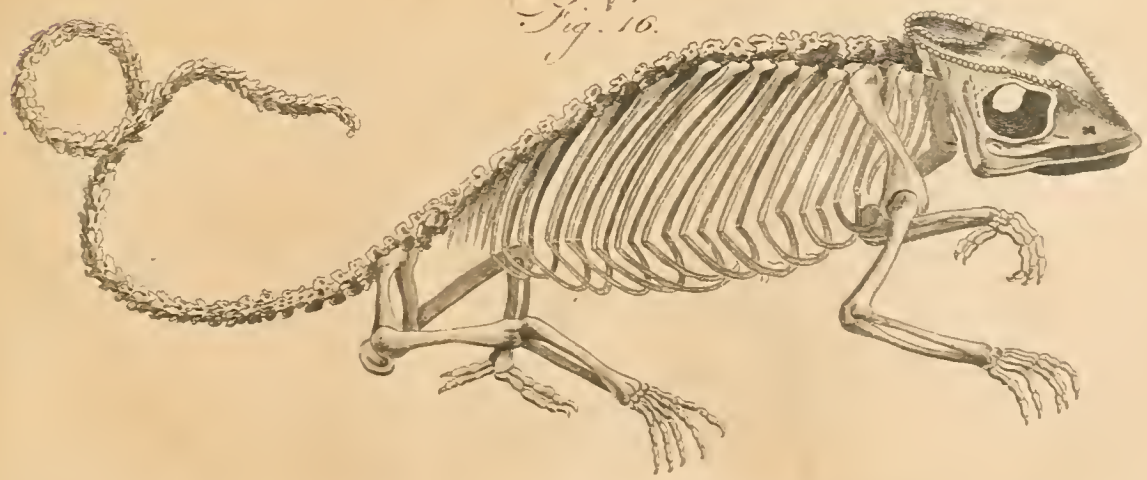


Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.



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ERR

Erratic || Error.

ERRATIC, in general, ſomething that wanders, or is not regular: hence it is the planets are called *erratic ſtars*.

ERRHINES, in *Pharmacy*, medicines which when ſnuffed up the noſe promote a diſcharge of mucus from that part. See MATERIA MEDICA *Index*.

Errhines prepared of cephalic herbs are of ſingular ſervice in oppreſſive pains of the head, a hemicrania, lethargic diſorders, weakneſſes of memory, ſtuffings of the head, and coryza, mucous defluxions of the eyes, drowſineſs, vertigoes, and in caſes where the malignant humours generated by the lues venerea are lodged in the membranes of the noſtrils.

ERROR, in *Philoſophy*, a miſtake of our judgment, giving aſſent to that which is not true.

Mr Locke reduces the cauſes of error to theſe four; firſt, want of proofs; ſecondly, want of ability to uſe them; thirdly, want of will to uſe them; and, fourthly, wrong meaſures of probability.

He obſerves upon the firſt of theſe cauſes of error, that the greateſt part of mankind want conveniences and opportunities of making experiments and obſervations themſelves, or of collecting the teſtimony of others, being prevented by the neceſſity of their condition. Upon the ſecond of theſe cauſes, he obſerves, that there are many, who, from the ſtate of their condition, might beſtow time in collecting proofs, but yet are not able to carry a train of conſequences in their heads, nor weigh exactly the preponderancy of contrary proofs and teſtimonies, merely from the difference in men's underſtandings, apprehenſions and reaſonings. Thirdly, he remarks, that though ſome have opportunities and leiſure enough, and want neither parts, learning, nor other helps, that they never come to the knowledge of ſeveral truths within their reach, either upon account of their attachment to pleaſure or buſineſs; or otherwiſe becauſe of their lazineſs or averſion to ſtudy. The fourth cauſe of error, viz. wrong meaſures of probability, he imputes, 1. To the practice of taking for principles propoſitions that are not in themſelves certain and evident, but, on the contrary, doubtful and falſe. 2. To received hypotheſes. 3. To predominant paſſions or inclinations. And, 4. To authority, or the giving up our aſſent to the common received opinions either of their friends or party, neighbours or country.

The cauſes of error in philoſophy, or the reaſons why all former philoſophers have through ſo many ages erred, according to Lord Bacon, are theſe following.

ERU

Error || Ervum

1. Want of time ſuited to learning. 2. The little labour beſtowed upon natural philoſophy. 3. Few entirely addicted to natural philoſophy. 4. The end of the ſciences wrong fixed. 5. A wrong way choſen. 6. The neglect of experiments. 7. Regard to antiquity and authority. 8. Admiration of the works in uſe. 9. The artifice of teachers and writers in the ſciences. 10. Oſtentatious promiſes of the moderns. 11. Want of propoſing worthy taſks. 12. Superſtition and zeal being oppoſite to natural philoſophy, as thinking philoſophy dangerous, on account of the ſchool theology; from the opinion that deep natural inquiries ſhould ſubvert religion. 13. Schools and academies proving unfavourable to philoſophy. 14. Want of rewards. And, 15. Deſpair, and the ſuppoſition of impoſſibility.

Error Loci. Boerhaave is ſaid to have introduced the term, from the opinion that the veſſels were of different ſizes for the circulation of blood, ſerum, and lymph; and that when the larger-ſized globules were forced into the leſſer veſſels by an error of place, they were obſtructed. But this opinion does not ſeem well grounded.

ERUCA, in general, denotes caterpillars of all kinds. The caterpillar ſtate is that through which inſects paſs before they arrive at perfection. See LARVA ENTOMOLOGY *Index*.

ERUDITION, denotes learning or knowledge; and chiefly that of hiſtory and antiquity, of languages and of books, which is the reſult of hard ſtudy and extenſive reading. The Scaligers were men of deep erudition: the writings of M. Launoy, a prieſt of the Oratory, are full of erudition.

Mr Locke ſays, it is of more uſe to fill the head with reflections than with points of erudition. If the mind be not juſt and right, ignorance is better than erudition, which only produces confuſion and obſcurity. M. Balzac calls a heap of ill-choſen erudition the luggage of antiquity.

ERUPTION, in *Medicine*, a ſudden and copious excretion of humours, as pus or blood: it ſignifies alſo the ſame with exanthema, any breaking out, as the puſtules of the plague, ſmall-pox, meaſles, &c.

ERUPTION *of Volcanoes*. See ÆTNA, VESUVIUS, VOLCANO, &c.

ERVUM, the LENTIL: A genus of plants, belonging to the diadelphia claſs; and in the natural method ranking under the 32d order, *Papilionaceæ*. See BOTANY *Index*.

ERYMANTHUS,

Erymanthus || Eryx.

ERYMANTHUS, a mountain, river, and town of Arcadia, where Hercules killed a prodigious boar, which he carried on his ſhoulders to Euryſtheus; who was ſo terrified at the ſight, that he hid himſelf in a brazen veſſel.

ERYNGIUM, SEA-HOLLY, or *Eryngo*: A genus of plants, belonging to the pentandria claſs; and in the natural method ranking under the 45th order, *Umbellatæ*. See BOTANY *Index*.

ERYSIMUM, HEDGE-MUSTARD: A genus of plants, belonging to the tetradynamia claſs, and in the natural method ranking under the 29th order, *Siliquoſæ*. See BOTANY *Index*.

ERYSIPELAS, in *Medicine*, an eruption of a fiery or acrid humour, from which no part of the body is exempted, though it chiefly attacks the face. See MEDICINE *Index*.

ERYTHEA, or ERYTHIA, an iſland adjoining, according to the ancients, either to or a part of Gades; nowhere now to be found by the deſcription given of it by ancient authors. The poets feign this to be the habitation of the fabulous Geryon, diſarmed by Hercules, who drove away his cattle.

ERYTHRÆ, in *Ancient Geography*, a port-town of Ætolia, on the Corinthian bay. Another Erythræ of Bœotia, near Platæa and Mount Cithæron. A third Erythræ, a town of Ionia in the Hither Aſia, ſituated in the peninſula, at its extremity, with a cognominal port. The Erythræans laid claim to the Sibyl Herophile, as their countrywoman, ſurnamed thence *Erythræa*. Erythræ was famous for an ancient temple of Hercules.

ERYTHRÆA, a town of Crete, ſituated in the ſouth-eaſt of the iſland, at the promontory Erythræum.

ERYTHRÆUM MARE, erroneouſly called *Rubrum* by the Romans. Thus the ocean that waſhes Arabia and Perſia, and extends a great way farther, is denominated. Hence it is, Herodotus ſays, that the Euphrates and Tigris fall into the Mare Erythræum. He alſo calls it the *South Sea*, on which the Perſians dwell. It takes its name, not from its colour, the error of the Romans, who tranſlated *Erythræum* "Rubrum;" but from *Erythras*, ſon of Perſeus and Andromeda, whoſe kingdom lay on the confines of that ſea; whence its name *Erythræum*.

ERYTHRINA, CORAL TREE: A genus of plants, belonging to the diadelphia claſs; and in the natural method ranking under 32d order, *Papilionaceæ*. See BOTANY *Index*.

ERYTHRINUS, in *Ichthyology*, a ſpecies of SPARUS. See ICHTHYOLOGY *Index*.

ERYTHROIDES, in *Anatomy*, the firſt of the proper tunics or coats which cover the teſticles.

ERYTHRONIUM, DOG'S-TOOTH VIOLET: A genus of plants, belonging to the hexandria claſs; and in the natural method ranking under the 11th order, *Sarmentaceæ*. See BOTANY *Index*.

ERYTHROXYLON, a genus of plants, belonging to the decandria claſs. See BOTANY *Index*.

ERYX, a ſon of Butes and Venus, who relying upon his ſtrength, challenged all ſtrangers to fight with him in the combat of the ceſtus. Hercules accepted his challenge after many had yielded to his ſuperior dexterity; and Eryx was killed in the combat, and buried on the mountain, where he had built a temple to Venus. Virg. Æn. 5. v. 402. A mountain of Sicily near Drepanum, which received its name from Eryx, who was buried there. This mountain was ſo ſteep, that the houſes which were built upon it ſeemed every moment ready to fall. Dædalus had enlarged the top, and incloſed it with a ſtrong wall. He alſo conſecrated there to Venus Erycina a golden heifer, which reſembled life ſo much, that it ſeemed to exceed the power of art.

Erzerum || Eſcalade.

ERZERUM, or ERZERON, a city of Turkey in Aſia, and capital of Armenia, or Turcomania. It is a pretty large town, five days journey from the Black ſea, and ten from the frontiers of Perſia. It ſtands in a delightful plain, at the foot of a chain of mountains, which hinder the Frat, or Euphrates, from falling into the Black ſea. A neighbouring hill ſupplies very fine ſprings, which not only water the fields, but the ſtreets of the town. Erzerum is ſurrounded with double walls, defended by pentagonal towers; but the ditches are neither deep nor well kept up. The beglerbeg, or baſhaw of the province, lives in the ſeraglio, which is very ill built. They reckon that there are 18,000 Turks at Erzerum, 6000 Armenians, and 10,000 Greeks. The Armenians have a biſhop and two churches; and the Greeks have alſo a biſhop, but the church is a miſerable place. The laſt are moſtly braziers, inhabiting the ſuburbs, who work the copper brought from the neighbouring mountain. They drive a great trade in copper utenſils and furs, particularly martins ſkins. Five or ſix days journey from the town there are oaks that produce plenty of gall-nuts, which are brought hither. This place is the thoroughfare and reſting place of all the merchants trading to the Indies, eſpecially when the Arabs are watching for their prey round Aleppo and Bagdad. E. Long. 40. 50. N. Lat. 29. 46.

ESARHADDON, the ſon of Sennacherib, and his ſucceſſor in the kingdom of Aſſyria. He is ſaid to have reigned 29 years at Nineveh, from the year 3294 to 3322; beſides which he reigned 13 years at Babylon, in all 42 years. He died in the year of the world 3336, and was ſucceeded by Saoſduchinus. Eſarhaddon, in the opinion of Sir Iſaac Newton, ſeems to be the Sardanapalus who died, as Cleitarchus ſays, of old age, after the revolt of Syria; the name *Sardanapalus* being derived from *Aſſerhadon Pul*.

ESCALADE, or SCALADE, a furious attack of a wall or a rampart; carried on with ladders, to paſs the ditch or mount the rampart; without proceeding in form, breaking ground, or carrying on regular works to ſecure the men.

When the troops are prepared to paſs the ditch, either with the aſſiſtance of boards, hurdles, and faſcines, when it is muddy, or with ſmall boats of tin, or baſkets covered with ſkins or oil-cloth, when it is deep and filled with water, a party muſt be placed on the counterſcarp, oppoſite to the landing-place, ready to fire at the garriſon if they are alarmed, and oppoſe the mounting on the rampart. If the ditch is dry, the ladders are fixed in ſome place fartheſt diſtant from the centry; and as ſoon as they get upon the rampart, they put themſelves in order to receive the enemy; if the centry ſhould be ſurpriſed and ſilently overcome, the detachment haſtens to break open the gate, and to let in the reſt of the party. If the ditch is wet, the rampart high, and provided with a revetement, it will

Eſcallonia ‖ Eſcheat.

be difficult to ſurpriſe the town in this way; but if there is no revetement, the troops may hide themſelves along the outſide of the rampart till all are over. Since the invention and uſe of gunpowder, and the walls of cities have been flanked, they are ſeldom taken by eſcalade.

ESCALLONIA, a genus of plants, belonging to the pentandria claſs. See BOTANY *Index*.

ESCAPE, in *Law*; a violent or privy evaſion out of ſome lawful reſtraint, without being delivered by due courſe of law. There are two ſorts of eſcapes, voluntary and negligent. Voluntary, when a man arreſts another for felony, or other crime, and afterwards lets him go freely by conſent; in which caſe, the party that permits ſuch eſcape is held guilty, committed, and muſt anſwer for it. Negligent eſcape, on the contrary, is where one is arreſted, and afterwards eſcapes againſt the will of the perſon that arreſted him, and is not purſued with freſh ſuit, and retaken before the perſon purſuing hath loſt ſight of him. By ſtat. 8 and 9 Will. III. c. 26. the keepers of priſons conniving at eſcapes ſhall forfeit 500l.; and in civil caſes the ſheriff is anſwerable for the debt.

ESCHALOT, or SHALLOT. See ALLIUM.

ESCHAR, in *Surgery*, the cruſt or ſcab occaſioned by burns or cauſtic medicines.

ESCHARA, in *Natural Hiſtory*, the name of a ſpecies of coralline, &c. the characters of which are theſe: they are of a ſtony or coral-like hardneſs, and reſemble a woven cloth in their texture; and the microſcope informs us, that they conſiſt of arrangements of very ſmall cells, whoſe ſurfaces appear much in that form. Linnæus makes it a ſpecies of millepora, in the claſs of lithophytes.

ESCHEAT, in *Law*, ſignifies any land or tenements that caſually fall to a lord within his manor. It is one of the conſequences of tenure in chivalry: (See *FEODAL Syſtem*, *KNIGHT-ſervice*, and TENURE). It is the determination of the tenure or diſſolution of the mutual bond between the lord and tenant, from the extinction of the blood of the latter by either natural or civil means: if he died without heirs of his blood, or if his blood was corrupted and ſtained by commiſſion of treaſon or felony; whereby every inheritable quality was entirely blotted out and aboliſhed. In ſuch caſes the land eſcheated or fell back to the lord of the fee; that is, the tenure was determined by breach of the original condition, expreſſed or implied in the feodal donation. In the one caſe, there were no heirs ſubſiſting of the blood of the firſt feudatory or purchaſer, to which heirs alone the grant of the feud extended: to the other, the tenant, by perpetrating an atrocious crime, ſhowed that he was no longer to be truſted as a vaſſal, having forgotten his duty as a ſubject; and therefore forfeited his feud, which he held under the implied condition that he ſhould not be a traitor or a felon. The conſequence of which in both caſes was, that the gift being determined, reſulted back to the lord who gave it.

The word *eſcheat* is ſometimes uſed for the place or circuit within which the king or other lord is intitled to eſcheats; alſo for a writ to recover the ſame from the perſon in poſſeſſion after the tenant's death.

ESCHEAT, in *Scots Law*, is that forfeiture which is incurred upon a perſon's being denounced a rebel. See LAW, Part III. N° clxvi. 12.

ESCHEVIN, or ECHEVIN (*Scabinus*), in the French and Dutch polity, a magiſtrate elected by the inhabitants of a city, to take care of their common concerns, the good order, conveniency, and decoration of the city, &c.

Eſcheyia ‖ Eſculent.

At Paris there were formerly a prevôt and four *eſchevins*; in moſt other cities a mayor and *eſchevins*. In Languedoc, Provence, and Dauphiné, they were called *conſuls*; at Toulouſe, *capitouls*; and *jurats* at Bourdeaux.

Anciently the *eſchevins* were the aſſeſſors and counſellors of the comites or judges of cities; on which account they were called in ſome places *pairs*, *pares*; they even took cognizance of petty cauſes themſelves.

Du-Cange obſerves, that the judges and their aſſeſſors, who were choſen by the inhabitants, were called *ſcabini* "eſchevins," and their college *ſcabinagium* or "eſchevinage."

In Holland, the *ſcabins* or *eſchevins* judge of all civil affairs at firſt hand. They alſo take cognizance of criminal matters: and if the criminal confeſs himſelf guilty, they can ſee their ſentence executed without appeal. They can even give torture. The number is not the ſame in all cities; at Amſterdam there are nine, at Rotterdam ſeven, &c.

ESCHRAKITES, or ESRAKITES, a ſect of philoſophers, among the Mahometans, who adhere to the doctrines and opinions of Plato. The word is derived from the Arabic שרק *ſchraca*, which in the fourth conjugation אשרק *aſchraca*, ſignifies "to ſhine, glitter like the ſun" ſo that *Eſchrakite* ſeems to import "illumined."

The *Eſchrakites*, or Mahometan Platoniſts, place their higheſt good and happineſs in the contemplation of the Divine Majeſty; deſpiſing the groſs imaginations of the Alcoran touching paradiſe. They are very careful in avoiding all vice; they preſerve an equal and eaſy temper, love muſic, and divert themſelves with compoſing little poems or ſpiritual ſongs. The ſhaeicks or prieſts, and the chief among the preachers of the imperial moſques, are Eſchrakites.

ESCLAIRCISSEMENT, a French term adopted into our language, ſignifying the explaining or clearing up of ſome difficulty or obſcurity.

ESCORT, a French term, ſometimes uſed in Engliſh authors to denote a convoy or company of armed men, attending ſome perſon or thing, in a journey or voyage, to defend or ſecure it from inſults. Some derive the word from the Latin *cohors*.

ESCOUADE, or SQUAD, is uſually the third or fourth part of a company of foot: ſo divided for mounting guards, and for the more convenient relieving of one another. It is equivalent to brigade of a troop of horſe. See BRIGADE.

ESCUAGE, in our old cuſtoms, a kind of knight-ſervice, called *ſervice of the ſhield*, by which the tenant was bound to follow his lord to the wars at his own charge. See the articles CHIVALRY, *FEODAL Syſtem*, and *KNIGHT-Service*.

ESCULAPIUS. See ÆSCULAPIUS.

ESCULENT, an appellation given to ſuch plants, or the roots of them, as may be eaten: ſuch are beets, carrots, artichokes, leeks, onions, parſnips, potatoes, radiſhes, ſcorzonera, &c.

ESCURIAL,

Eſcurial. ESCURIAL, a royal reſidence of Spain, ſituated about 15 miles north-weſt of Madrid. It is the largeſt and moſt ſuperb ſtructure in the whole kingdom, and perhaps one of the fineſt in Europe. The word is Arabic, meaning "a place full of rocks." It is built in a dry barren ſpot, ſurrounded with rugged mountains, inſomuch that every thing which grows there is owing to art. This place was choſen, it is ſaid, for the ſake of the ſtone wherewith the fabric was built, which is got from a mountain juſt by, and is very durable; and the deſign of erecting it was to commemorate a victory which Philip II. obtained over the French (but by the aſſiſtance of the Engliſh forces) at St Quintin, on St Laurence's day, in the year 1557. The Spaniſh deſcription of this ſtructure forms a ſizeable quarto volume, and it is ſaid that its founder expended upon it ſix millions of ducats. The apartments are decorated with an aſtoniſhing variety of paintings, ſculpture, tapeſtry, ornaments of gold and ſilver, marble, jaſper, gems, and other curious ſtones, ſurpaſſing all imagination. This building, beſides its palace, contains a church, large and richly ornamented; a mauſoleum; cloiſters; a convent; a college; and a library, containing about 30,000 volumes; beſides large apartments for all kinds of artiſts and mechanics, noble walks, with extenſive parks and gardens, beautified with fountains and coſtly ornaments. The fathers that live in the convent are 200, and they have an annual revenue of 12,000l. It was begun by Philip in 1562, five years after the battle; and completed in 22 years. It conſiſts of ſeveral courts and quadrangles, which altogether are diſpoſed in the ſhape of a gridiron, the inſtrument of the martyrdom of St Laurence; the apartments where the king reſides form the handle. The building is a long ſquare of 640 by 580, and the height up to the roof is all round 60 feet, except on the garden ſide, where the ground is more taken away. At each angle is a ſquare tower 200 feet high. The number of windows in the weſt front is 200; in the eaſt front 366. The orders employed are Doric and Ionic. There are three doors in the principal front. Over the grand entrance are the arms of Spain, carved in ſtone; and a little higher in a niche, a ſtatue of St Laurence in a deacon's habit, with a gilt gridiron in his right hand, and a book in his left. Directly over the door is a baſſo-relievo of two enormous gridirons in ſtone. This vaſt ſtructure, however, with its narrow high towers, ſmall windows, and ſteep ſloping roof, exhibits a very uncouth ſtyle of architecture: at the ſame time that the domes, and the immenſe extent of its fronts, render it a wonderfully grand object from every point of view. The church, which is in the centre of all, is large, awful, and richly but not affectedly ornamented. The cupola is bold and light. The high altar is compoſed of rich marbles, agates, and jaſpers of great rarity, the produce of this kingdom. Two magnificent *catafalquas* fill up the ſide arcades of this ſanctuary: on one the emperor Charles V. his wife, daughter, and two ſiſters, are repreſented in bronze, larger than life, kneeling; oppoſite are the effigies of Philip II. and of his three wives, of the ſame materials, and in the ſame devout attitude. Underneath is the burial-place of the royal family, called the *Pantheon*. Twenty five ſteps lead down to this vault, over the door of which is an inſcription, denoting, that

Hic locus, facer mortalitatis exuviis Catholicorum Regum, &c.

Eſcurial || Eſdras.

was intended by Charles the emperor, reſolved upon by Philip II. begun by Philip III. and completed by Philip IV. The mauſoleum is circular, 36 feet diameter, incruſted with fine marbles in an elegant taſte. The bodies of the kings and queens lie in tombs of marble, in niches, one above the other. The plan of theſe ſepulchres is grand, and executed with a princely magnificence; but, as a modern traveller obſerves, in a ſtyle rather too gay, too light, and too delicately fitted up for the idea we are apt to form of a chapel deſtined for the reception of the dead. The collection of pictures diſperſed about various parts of the church, ſacriſty, and convent, has been conſidered as equal, if not ſuperior, to any gallery in Europe except that of Dreſden. Formed out of the ſpoils of Italy, and the waſted cabinet of that unfortunate dilettante Charles I. of England, it contains ſome of the moſt capital works of the greateſt painters that have flouriſhed ſince the revival of the art. In the ſacriſty is an altar called *La ſanta Forma:* this is a kind of tabernacle or *cuſtioda* of gems, marbles, woods, and other precious materials, inlaid in gilt bronze; in which, rather than in the excellence of the workmanſhip or taſte of the deſign, conſiſts the merit of this rock of riches. Before it hangs a curtain, on which Coello has repreſented Charles II. and all his court in proceſſion, coming to place this *Forma*. This is eſteemed one of the moſt curious collections of portraits in the world; for all the perſons are drawn with the greateſt ſtrength of colour and truth of impreſſion, and are ſaid to be perfect reſemblances not only of the monarch and grandees, but even of the monks, ſervants, and guards. The ſtatues, buſts, and medallions of the Eſcurial, are not in any great number, or very remarkable for their excellence: but the library contains a moſt precious collection of manuſcripts, many fine drawings, and other curioſities. Notwithſtanding the coldneſs of the expoſure, the late king, for the ſake of hunting, uſed to paſs here ſeveral months of the year; and to make the place leſs inconvenient to his attendants and the nobility, he built an entire new town adjoining to it.

ESCUTCHEON, or Scutcheon, in *Heraldry*, is derived from the French *eſcuſſon*, and that from the Latin *ſcutum*, and ſignifies the ſhield whereon coats of arms are repreſented.

Moſt nations of the remoteſt antiquity were wont to have their ſhields diſtinguiſhed by certain marks painted on them; and to have ſuch on their ſhields was a token of honour, none being permitted to have them till they had performed ſome honourable action.

The eſcutcheon, as uſed at preſent, is ſquare, only rounded off at the bottom.

ESDRAS, a Jewiſh prieſt, and doctor of the law. Artaxerxes Longimanus ſent him with rich preſents for the uſe and ornament of the temple at Jeruſalem, rebuilt under Zerubbabel; the king alſo ordered the neighbouring governors to provide him with what conduced to the pomp of the Jewiſh religion, and to exempt the prieſts from paying taxes. He is ſuppoſed to be the collector of the Canon of Scripture; and that, by divine inſpiration, he added ſome things which happened

Esk || Esne.

pened after the deaths of the authors. It is gueſſed he wrote the Chronicles, beſides thoſe books which bear his name, the two laſt of which are exploded even by the church of Rome.

ESK, the name of ſeveral rivers both in England and Scotland, particularly of one which forms part of the boundary between the two kingdoms. It runs from north-eaſt to ſouth-weſt, and gives name to the diſtrict of Eſkdale.

ESKI-HISSAR. See STRATONICEA.

ESKIMAUX. See ESQUIMAUX.

ESNE, or ESNEH, a conſiderable ſea-port town of Upper Egypt. It is governed by an Arabian prince, and by a cachef, dependant on the bey of Girze. The Mahometans have ſeveral moſques here, and the Coptis a church ſerved by two prieſts. "Eſne (ſays Abulfeda), remarkable for its public baths and its commerce, is built on the weſtward of the Nile, between Aſſouan and Cous, but nearer to this latter. It acknowledges, adds the geographer of Nubia, the Coptis for founders. Its well cultivated territory abounds in grain and palm-trees. It is ſurrounded by gardens filled with fruit-trees. One admires here ſeveral ancient monuments conſtructed by the Coptis, and ſuperb ruins." This deſcription anſwers to Eſne in our time, which is ſituated on the edge of a rich country, and ſhaded by groves of orange trees loaded with fruits and flowers. This town, formerly called *Latopolis*, revered Minerva and the fiſh *Latus* (Strabo). It contains within its boundary an antique temple; thick walls incloſe it on three ſides. Six large fluted columns, crowned by a capital ornamented with the palm leaf, form the façade of it; 18 others ſupport the roof, which is compoſed of large ſquares of marble; the building is ſurrounded by a frieze, and innumerable hieroglyphics cover its exterior aſpects.

A little to the ſouth of the town are ſeen the ruins of a monaſtery founded by St Helena, and near it the burying-place of the martyrs, adorned with tombs crowned by cupolas, ſupported by arcades. The inhabitants of Eſne having revolted againſt the perſecution of Diocleſian, that emperor deſtroyed this town and put them to the ſword. This place, conſecrated by religion, is become a celebrated pilgrimage among the Coptis. They repair thither from the moſt diſtant provinces of the kingdom. In the chain of mountains which ſtretches to the eaſtward of the Nile, and nearly oppoſite Eſne, are quarries of a ſoft ſtone, called *Baram*. It is made uſe of for kitchen utenſils. It hardens in the fire, and forms excellent kettles and pans, which give no bad taſte to the victuals. This ſtone is probably the *lapis ollaris*, or *pot-ſtone*.

* *Trav.* ii. 103.

"Eſne (ſays Denon*) is the ancient Latopolis. Some remains are ſtill viſible of its port or quay on the bank of the Nile, which has been often repaired; but, notwithſtanding all that has been done for it, ſtill remains in a very miſerable condition. This town alſo contains the portico of a temple, which appears to me to be the moſt perfect monument of ancient architecture. It is ſituated near the bazar in the great ſquare, and would make an incomparable ornament to this ſpot, if the inhabitants had any idea of its merit; but inſtead of this they have deformed it by the moſt miſerable ruined hovels, and have devoted it to the vileſt purpoſes. The portico is very well preſerved, and poſſeſſes a great richneſs of ſculpture: it is compoſed of eighteen columns with broad capitals; theſe columns are noble and elegant, though they now appear in the moſt diſadvantageous light: the rubbiſh ſhould be cleared to find if any part of the *cella* remains.

Eſox || Eſpouſals.

"The hieroglyphics in relief, with which it is covered within and without, are executed with great care; they contain, among other ſubjects, a zodiac, and large figures of men with crocodiles heads: the capitals, though all different, have a very fine effect; and as an additional proof that the Egyptians borrowed nothing from other people, we may remark, that they have taken all the ornaments, of which theſe capitals are compoſed, from the productions of their own country, ſuch as the lotus, the palm-tree, the vine, the ruſh, &c. &c."

ESOX, a genus of fiſhes belonging to the order of abdominales. See ICHTHYOLOGY *Index*.

ESPALIERS, in *Gardening*, are rows of trees planted about a whole garden or plantation, or in hedges, in ſuch a manner as to encloſe quarters or ſeparate parts of a garden; and are trained up regularly to a lattice of wood-work in a cloſe hedge, for the defence of tender plants againſt the injuries of wind and weather. They are of admirable uſe and beauty in a kitchen-garden, ſerving not only to ſhelter the tender plants, but ſcreen them from the ſight of perſons in the walks.

The trees chiefly planted for eſpaliers, are apples, pears, and ſome plums: ſome plant apples grafted upon paradiſe ſtocks; but as theſe are of ſhort duration, it is better to plant thoſe grafted upon crabſtock, or upon what the gardeners call *Dutch ſtocks*; which will both cauſe them to bear ſooner, and prevent their growing too luxuriant. The beſt kinds of apple for this purpoſe, are the golden pippen, nonpareil, renette, &c. and the beſt ſorts of pear, are the jargonelle, blanquett, &c. Theſe laſt, if deſigned for a ſtrong moiſt ſoil, ſhould be grafted upon quince ſtocks; but if for a dry ſoil, upon free ſtocks.

While the trees are young, it will be ſufficient to drive a few ſtakes into the ground on each ſide of them; faſtening the branches to theſe in a horizontal poſition, as they are produced. This method will do for the three firſt years; after which an eſpalier ſhould be made of aſh-poles, whereof there muſt be two ſorts, larger and ſmaller; the former to be driven upright into the ground a foot aſunder, and the latter, or ſlender poles, to be nailed acroſs theſe, at about nine inches. Some prefer to this another ſort of eſpalier, made of ſquare timber cut to any ſize; theſe are, indeed, more ſightly, but withal vaſtly more expenſive.

When the eſpalier is thus framed, the branches are to be faſtened to it with oſier-twigs; obſerving to train them in a horizontal poſition, and at equal diſtances. Fruit trees thus managed are preferable to any others; not only as bearing better-taſted fruit, but as taking up very little room in a garden, ſo as to be leſs hurtful to plants which grow in the quarters.

ESPLANADE, in *Fortification*, the ſloping of the parapet of the covered-way towards the champaign.

ESPLEES, in *Law*, the general products which lands yield, or the profit or commodity that is to be taken or made of a thing.

ESPOUSALS, in *Law*, ſignify a contract or pro-

Esquiliæ ‖ Esquire.

miſe made between a man and a woman to marry each other; and in caſes where marriages may be conſummated eſpouſals go before. Marriage is termed an eſpouſal *de preſenti*.

The eſpouſals among the Jews were either by writing, or by a piece of ſilver given and received, or by cohabitation. Amongſt the Greeks, after the parents and friends of the young couple had finiſhed their negociation, the couple themſelves pledged their faith to each other, the man ſwearing that he would be conſtant and true, the woman that ſhe would marry him, and make him maſter of all ſhe had. Then they ratified their agreement by a kiſs and joining right hands.

Amongſt the Romans the eſpouſals conſiſted in an engagement of friends on both ſides, whether abſent or preſent, in public or without witneſſes. But the common way was by writings drawn up by common conſent, and ſealed by both parties: beſides this, the man ſent a ring to the woman, conſiſting of iron and without a ſtone.

ESQUILIÆ, in *Ancient Geography*, one of the ſeven hills of Rome, which Varro will have to be two, viz. Ciſpias and Oppius; alſo Mons Eſquilinus, ſoftened from Exquilinus; and this again from Excubinus, the watch or guard Romulus kept here, from a jealouſy he entertained of his colleague Titus Tatius. On the eaſt ſide it reached the city walls; on the ſouth, the Via Lavicana; on the weſt, the wide valley between Mount Coelius and the Palatine; on the north, the Mons Viminalis; on the eaſt ſide was the Porta Eſquilina. This hill by ſome of the ancients was called *Suburranus*, from the ſtreet *Suburra* to the north of it: by the poets, *Eſquilius*.

ESQUIMAUX, a people of North America inhabiting all that vaſt tract of land known by the name of *Labrador*, or *New Britain*. They differ very conſiderably, both in aſpect and manners, from the other American nations; agreeing in moſt reſpects with the inhabitants of Weſt Greenland. See *New* BRITAIN and GREENLAND.

ESQUIRE (from the French *eſcu*, and the Latin *ſcutum*, in Greeks σκυτος, which ſignifies a hide, of which ſhields were anciently made, and afterwards covered; for, in the time of the Anglo-Saxons, the ſhields had a covering of leather), was originally he who, attending a knight in time of war, did carry his ſhield; whence he was called *eſcuier* in French, and *ſcutifer*, or *armiger*, i. e. armour-bearer, in Latin. Hotoman ſays, that thoſe whom the French call *eſquires*, were a military kind of vaſſals, having *jus ſcuti*, viz. liberty to bear a ſhield, and in it the enſigns of their family, in token of their gentility or dignity. But this addition hath not of long time had any relation to the office or employment of the perſon to whom it hath been attributed, as to carrying of arms, &c. but hath been merely a title of dignity, and next in degree to a knight. For thoſe to whom this title is now due, ſee the article COMMONALTY. Officers of the king's courts, and of the king's houſehold, counſellors at law, juſtices of the peace, are only *eſquires* in reputation; and he who is a juſtice of peace has this title only during the time he is in commiſſion, and no longer, if he is not otherwiſe qualified to bear. A ſheriff of a county being a ſuperior officer, bears the title of *eſquire* during his life; in reſpect of the great truſt he has in the commonwealth. The chiefs of ſome ancient families are eſquires by preſcription; and in late acts of parliament for poll money, many wealthy perſons commonly reputed to be ſuch, were ranked among the eſquires of this kingdom.

Eſquires ‖ Eſſenes.

There is a general opinion, that every gentleman of landed property who has 300l. a-year, is an eſquire; which is a vulgar error: for no money whatſoever, or landed property, will give a man properly this title, unleſs he comes within one of the above rules: and no perſon can aſcribe this title where it is not due, unleſs he pleaſes; there being no difficulty in drawing the line by the accounts given above and in the article COMMONALTY: but the meaner ranks of people, who know no better, do often baſely proſtitute this title; and, to the great confuſion of all rank and precedence, every man who makes a decent appearance, far from thinking himſelf any way ridiculed by finding the ſuperſcription of his letters thus decorated, is fully gratified by ſuch an addreſs.

Esquires of the king, are ſuch as have that title by creation, wherein there is ſome formality uſed, as the putting about their necks a collar of SS. and beſtowing on them a pair of ſilver ſpurs, &c.

ESRAKITES. See ESCHRAKITES.

ESSAY, a trial or experiment for proving the quality of any thing; or an attempt to learn, whether or not any invention will ſucceed.

ESSAY, in literature, a peculiar kind of compoſition, the character whereof is to be free, eaſy, and natural; not tied to ſtrict order or method, nor worked up and finiſhed like a formal ſyſtem.

ESSAYING, or ASSAYING, in *Chemiſtry* and *Metallurgy*, ſignifies the examination of a ſmall quantity of any ore or mineral by fire, in order to diſcover the quantity of metal it contains. This is very neceſſary for thoſe who intend to deal largely in metallurgic operations, in order to avoid unneceſſary expence, by becoming previouſly acquainted with the nature of the ore. See CHEMISTRY and MINERALOGY *Index*.

Essay-Hatch, is the miners term for a little trench or hole, which they dig to ſearch for ſhoad or ore.

ESSEDARII, a ſort of gladiators, mentioned by Seneca, Suetonius, and Tully, who on ſome occaſions engaged one another out of chariots called *eſſeda*. The *eſſedum* was a ſort of heavy chariot from which the Gauls and Britons engaged the Romans. See GLADIATOR.

ESSENCE, in *Metaphyſics*, that which conſtitutes the particular nature of each genus or kind, and diſtinguiſhes it from all others: being nothing but that abſtract idea to which this name is affixed, ſo that every thing contained in it is eſſential to that particular kind.

This Mr Locke calls the *nominal eſſence*; in contradiſtinction to the real eſſence, or conſtitution of ſubſtances on which this nominal eſſence depends. Thus the nominal eſſence of gold is that complex idea the word *gold* ſtands for; let it be, for inſtance, a body, yellow, weighty, malleable, fuſible, and fixed: but its real eſſence is the conſtitution of its inſenſible parts, on which theſe qualities and all its other properties depend, which is wholly unknown to us.

ESSENES, or ESSENIANS, in Jewiſh antiquity, one

Eſſential, Eſſex.

one of the three ancient ſects among that people. They allowed a future ſtate, but denied a reſurrection from the dead. Their way of life was very ſingular: they did not marry; but adopted the children of others, whom they bred up in the inſtitutions of their ſect: they deſpiſed riches, and had all things in common, and never changed their clothes till they were entirely worn out. When initiated, they were ſtrictly bound not to communicate the myſteries of their ſect to others; and if any of their members were found guilty of enormous crimes, they were expelled.

Pliny tells us, that they dwelt on the weſt ſide of the lake of Aſphaltites; and that they were a ſolitary kind of men, living without women or money, and feeding upon the fruit of the palm-tree: he adds, that they were conſtantly recruited by new comers, whom the ſurges of ill fortune had made weary of the world: in which manner the ſect was kept up for ſeveral thouſands of years, without any being born among them. The reaſon why we find no mention made of them in the New Teſtament, may be their recluſe and retired way of life, not leſs than their great ſimplicity and honeſty, whereby they lay open to no cenſure or reproof.

ESSENTIAL, ſomething neceſſarily belonging to a thing, from which it cannot be conceived diſtinct: thus the primary qualities of bodies, as extenſion, figure, number, &c. are eſſential or inſeparable from them in all their changes and alterations.

Essential Oils are ſuch as are really contained in a plant, and are drawn from it by diſtillation in an alembic with water: they are thus called, in contradiſtinction to empyreumatic oils, which are raiſed by a naked fire without water.

ESSEX, a county of England, bounded on the north by the Stour, which ſeparates it from Suffolk and Cambridgeſhire; on the eaſt, by the German ſea; on the weſt, by Hertfordſhire and Middleſex; and on the ſouth by the river Thames. It extends 46 miles in length from eaſt to weſt and about 42 in breadth from north to ſouth, and 200 in circuit. This county is in the dioceſe of London, and gives the title of earl to the family of Capel. The county of Eſſex is divided into nineteen hundreds, and contains twenty-ſeven market-towns, 415 pariſhes, 125 vicarages, and 1100 villages. It ſends eight members to parliament; namely, two for the county, and two for Colcheſter, Harwich, and Malden. The air in the inland parts is healthy; but in the marſhes near the ſea it produces agues, particularly in the part called the Hundreds. However, the fertility of the unwholeſome part is very great, and even the higher grounds of this county are very fruitful. About Saffron Walden, the earth, after bearing ſaffron three years, it is ſaid, will produce good barley for 18 years ſucceſſively without any manure. Its produce, which is very plentiful, conſiſts of corn, moſt excellent ſaffron, cattle, fowl, fiſh, and particularly oyſters. The chief manufactures of this county are cloth, ſtuffs, and particularly baize. The principal rivers, beſides the Thames, are the Stour, which falls into the German ſea at Harwich; the Lea, its weſtern boundary, falls into the Thames below Stratford; the Blackwater runs through the heart of the county, and paſſing by Chelmsford is joined by the Chelmer, and from thence runs into the German ſea; the Coln runs by Halſted to Colcheſter, and ſo into the ſea. The Roding which riſes northwards, near Dunmow, runs into the Thames near Barking. All theſe rivers abound in moſt ſorts of fiſh.

Eſtate ‖ Eſtonia.

In the year 1801, the total number of inhabitants in the county of Eſſex amounted to 226,437 perſons. Of theſe 111,356 are males, and 115,081 are females. They are divided into 46,784 families, occupying 38,371 houſes. The number employed in agriculture is 65,174; and in trade, manufactures, &c. 25,283.

ESTATE, in *Law*, ſignifies the title or intereſt that a perſon has in lands, tenements, or other effects; comprehending the whole in which a perſon hath any property, and will paſs the ſame.

Eſtates are either real or perſonal; otherwiſe diſtinguiſhed into FREEHOLDS, which deſcend to heirs; or CHATTELS, that go to executors or adminiſtrators.

A fee-ſimple is the ampleſt eſtate our law admits of. See FEE.

Eſtates are obtained ſeveral ways; as, by deſcent from a father to a ſon; by conveyance or grant from one perſon to another; by gift or purchaſe; or by deed or will. See DESCENT, SUCCESSION, TENURE, &c.

ESTATES, in a political ſenſe, is uſed either to denote the dominions of ſome prince, or the general claſſes into which the people are divided.

In Britain, the eſtates are the king, lords, and commons; or rather the lords and commons, who meet the king in parliament, for reforming abuſes, and enacting good and wholeſome laws.

ESTHER, a canonical book of the Old Teſtament; containing the hiſtory of a Jewiſh virgin, dwelling with her uncle Mordecai at Shuſhan, in the reign of Ahaſuerus, one of the kings of Perſia.

The great beauty of this maid raiſed her to the throne of Perſia; whereby ſhe had an opportunity to ſave her countrymen, whoſe deſtruction was plotted by Haman, a favourite of that prince.

The learned are not agreed who this Ahaſuerus was. Archbiſhop Uſher ſuppoſes him to be Darius Hyſtaſpes, and Artyſtona to be Eſther. Scaliger makes him the ſame with Xerxes, and his queen Haneſtris to be Eſther. Joſephus, on the contrary, poſitively aſſerts, that the Ahaſuerus of the ſcriptures, is the Artaxerxes Longimanus of profane ſtory; and the Septuagint, throughout the whole book of Eſther, tranſlate Ahaſuerus by Artaxerxes. Moſt people ſubſcribe to this laſt opinion; and indeed the extraordinary kindneſs ſhowed by Artaxerxes to the Jews, can ſcarcely be accounted for otherwiſe than by ſuppoſing that they had ſo powerful an advocate as Eſther to ſolicit for them.

ESTOILE'E, or CROSS ESTOILLE'E, in *Heraldry*, a ſtar with only four long rays in form of a croſs; and, accordingly, broad in the centre, and terminating in ſharp points.

ESTONIA, is a province of the Ruſſian empire, and part of Livonia. It is bounded on the eaſt by the Baltic ſea, on the north by the gulf of Finland, on the weſt by Ingria, and on the ſouth by Lettonia. It is divided into ſix diſtricts: 1. Harrien; 2. Wieland; 3. Alentakin; 4. Wich; 5. Jerven; and, 6. Odenoa.

Eſtoppel || Eſtremadura.

The principal towns are, Revel, Weiſenberg, Borchholm, Narva, Nyſlot, Habſal, Derpt, St Elin, Pernau, and Roderſwick.

In former times the inhabitants of this country carried on a good trade in corn, which was dried in ſtoves: but wars have much depopulated the country, inſomuch that not a fourth part of it is inhabited, and a great number of gentlemen's ſeats lie in ruins.

ESTOPPEL (formed of the French *eſtouper*, *oppilare*, *obſtipare*, "to ſtop, or block up"), in *Law*, an impediment or bar of action, ariſing from a man's own act or deed; againſt which a man is forbidden, by law, to ſpeak, though it be to ſay the truth.

ESTOVERS, in *Law*, is uſed, by Bracton, for that ſuſtenance which a man, committed for felony, is to have out of his lands or goods for himſelf and his family during impriſonment. In ſtat. 6 Edw. I. it is uſed for an allowance in meat or clothes. In ſome manors, the tenants have *common of eſtovers*; that is, neceſſary botes or allowances out of the lord's wood: in which laſt ſenſe, eſtovers comprehends houſe-bote, hay-bote, and plow-bote; ſo that if a man have in his grant theſe general words, *de rationabili eſtoverio in boſcis*, &c. he may thereby claim all three.

Eſtovers is alſo uſed for alimony, which, if the huſband refuſes to pay, there is, beſides the ordinary proceſs of excommunication, a writ at common law, *de eſtoveriis habendis*, in order to recover it.

ESTRAY, or STRAY, ſignifies any tame beaſt, as ſheep, oxen, ſwine, and horſes, or ſwans, found within a lordſhip, and not owned by any man; in which caſe being cried, according to law, in the church, and two market towns adjoining, if it be not claimed by the owner within a year and a day, it becomes the lord's of the ſoil where found. If the owner claims it within the year and day, he muſt pay the charges of finding, keeping, and proclaiming them; and he may ſeize it, without telling the marks or proving his property, which may be done at the trial if conteſted. If the beaſt ſtray within the year to another lordſhip, the firſt lord cannot retake it. An eſtray muſt be fed and kept, uninjured, and without labour, till it is reclaimed or the limited time expires.

ESTREAT, EXTRACTUM, in *Law*, is uſed for the true copy or duplicate of ſome original writing, eſpecially of amercements or penalties ſet down in the rolls of a court, to be levied by the bailiff or other officer, on every offender.

ESTREMADURA, a province of Spain, has New Caſtile on the eaſt, Leon on the north, Andaluſia on the ſouth, and Portugal on the weſt. It is 175 miles in length, and 100 in breadth; and its principal towns are, Calatrava, Menda, and Badajoz, on the river Guadiana; Alcantara, on the Tajo; and Cona and Placentia, to the north of this river.

This province enjoys a very pure and healthful air, and its mountains are full of wild and tame animals; they having woods and foreſts for the one ſort, and paſtures for the other. The fields are planted with fruit-trees, which bear all kinds of delicious fruit. The vineyards produce excellent wines of all colours, and the fields yield plenty of corn.

ESTREMADURA, a province of Portugal, near the mouth of the Tagus or Tajo, bounded on the north by Beira, on the eaſt and ſouth by Alentejo, and on the weſt by the Atlantic ocean. It is about 88 miles in length, and 45 in breadth. This province is divided into ſix comarcas, viz. Litria, Liſbon, Tomar, Santaren, and Alanquar, to the north of the Tagus; and that of Setubal, to the ſouth of this river. Theſe are likewiſe the principal towns. Eſtremadura is equal, if not preferable, to any other province in Spain or Portugal. The diſtrict of Santaren produces ſuch plenty of corn, and feeds ſo many flocks of ſheep, that it may enter into competition with Sicily. The fruits and the wines are all excellent; and it was here that the ſweet oranges brought from China were firſt planted, and of which there are large quantities tranſported to foreign parts, with the wines and other fruits. The fields are covered with flowers almoſt all the year, from which the bees collect large quantities of fine honey. The olive-trees are numerous, from which they have excellent oil. The rivers abound with good fiſh, and the mountains have quarries of ſeveral kinds.

Etching.

ETCHING, a method of engraving on copper, in which the lines or ſtrokes, inſtead of being cut with a tool or graver, are eaten in with aquafortis. See ENGRAVING.

Etching is of a later invention, though not very modern, than engraving with the tool; of which it was at firſt only an imitation, that was practiſed by painters and other artiſts, who could much ſooner form their hands to, and attain a faculty of, working in this way, than with the graver. But being then nevertheleſs conſidered as a counterfeit kind of engraving, and therefore inferior to the other, it was cultivated in a very confined manner; the cloſeneſs of the reſemblance of the work to that performed by the tool, being made the teſt of its merit, and conſequently the principal object of aim in thoſe who purſued it. This ſervile confinement of the art of etching to the imitation of the original kind of engraving, was a great cauſe of retarding its advancement towards perfection, as many of the moſt able maſters cramped their talents with the obſervance of it: which may be ſeen in the inſtances of Sadelers, Swaneberg, Villamena, and particularly Le Boſſe; who, in his treatiſe on engraving, has laid down as a principle, that the perfection of this kind conſiſts in the cloſe ſimilitude of the work with that done by the tool. This abſurd prepoſſeſſion has been ſince worn out: and the method of working with aquafortis has been ſo far improved, that inſtead of being now deemed a ſpurious kind of engraving, it evidently appears the foundation of an excellence in many modern works, that could never have been produced without it: ſince, though the neatneſs and uniformity of the hatches, which attend the uſe of the tool, is more advantageous with reſpect to portraits; yet the liberty and facility of the other manner give a much greater opportunity to exerciſe the force of genius and fancy in hiſtory-engraving; where the effect of the whole, and not the minute exactneſs in finiſhing all the parts, conſtitutes the principal value.

There are two methods practiſed of engraving in this way; the one with a hard varniſh or ground, the other with a ſoft. The firſt was formerly much uſed, being better accommodated to the intention of imitating the engraving with the tool; as the firmneſs of the body of the varniſh gave more opportunity of retouching the lines,

Etching. lines, or enlarging them with the oval-pointed needles, called by the French *echoppes* as was practiſed by Le Boſſe and others for that purpoſe. The latter has now almoſt wholly ſuperſeded the uſe of the other, by the free manner of working it admits of; which affords a power of expreſſion incompatible with the greater inflexibility of the hard varniſh, that confines the lines and hatches to ſuch a regularity and ſameneſs, as gives a ſtiffneſs of manner and coldneſs of effect to the work.

The mixture of the uſe of the tool and aquafortis, which are now both employed in many caſes, has, however, given that perfection to engraving which it poſſeſſes at preſent. The truth and ſpirit of the outline that the method of working with aquafortis affords, and the variety of ſhades which the different kinds of black produce in this way, as well as other means of expreſſing the peculiar appearance and character of particular ſubjects, furniſh what was defective in the ſole uſe of the tool; while, on the other hand, the exactneſs and regularity of the lines, which are required for finiſhing many kinds of deſigns, are ſupplied by the graver; and by a judicious application of both, that complete finiſhing is obtained, which either of them alone muſt neceſſarily want.

The manner by which this art is performed, is the covering the ſurface of the plate with a proper varniſh or *ground*, as it is called, which is capable of reſiſting aquafortis; and then ſcoring or ſcratching away, by inſtruments reſembling needles, the parts of this varniſh or ground, in the places where the ſtrokes or hatches of the engraving are intended to be; then, the plate being covered with aquafortis, the parts that are laid naked and expoſed by removing the ground or varniſh, are corroded or eaten away by it; while the reſt, being ſecured and defended, remain untouched.

There are two methods of etching, as has been already obſerved; the difference of which from each other conſiſts, as well in the difference of the varniſh or ground, as in that of the aquafortis, adapted to each kind; but the general methods of performing them are alike in both. Theſe varniſhes or grounds are diſtinguiſhed by the names of *hard* and *ſoft*: for in their conſiſtence, or the reſiſtance they give to the needles, lies their eſſential variation from each other. The hard varniſh, it is with good reaſon conjectured, was not the firſt in uſe: but ſoon took place of the other; and was, for ſome time, the moſt received in practice, on account of its admitting the work to be made more like that of the graver: the ſoft has, however, ſince, in its turn, prevailed to the excluſion of it in ſome degree, except in the caſe of particular ſubjects; but not ſo entirely as to take away the expedience of ſhowing how it is performed. The manner of etching with the ſoft varniſh is now, however, one of the moſt important objects of the art of engraving; and it is at preſent in univerſal uſe, ſometimes alone, but more frequently intermixed with the work of the tool, and in ſome caſes with great advantage, even where the whole is intended to paſs for being performed by the graver.

Preparation of the ſoft varniſh; according to Mr Lawrence, an eminent Engliſh engraver at Paris. "Take of virgin wax and aſphaltum, each two ounces; of black pitch and Burgundy pitch, each half an ounce. Etching. Melt the wax and pitchin a new earthen-ware glazed pot; and add to them by degrees, the aſphaltum finely powdered. Let the whole boil till ſuch time as that, taking a drop upon a plate, it will break when it is cold, on bending it double two or three times betwixt the fingers. The varniſh being then enough boiled, muſt be taken off the fire; and letting it cool a little, muſt be poured into warm water, that it may work the more eaſily with the hands, ſo as to be formed into balls; which muſt be rolled up, and put into a piece of taffety for uſe."

It muſt be obſerved, firſt, that the fire be not too violent, for fear of burning the ingredients; a ſlight ſimmering will be ſufficient: ſecondly, that while the aſphaltum is putting in, and even after it is mixed with them, the ingredients ſhould be ſtirred continually with the ſpatula; and thirdly, that the water, into which this compoſition is thrown, ſhould be nearly of the ſame degree of warmth with it, to prevent a kind of cracking that happens when the water is too cold.

The varniſh ought always to be harder in ſummer than in winter; and it will become ſo if it be ſuffered to boil longer, or if a greater proportion of the aſphaltum or brown reſin be uſed. The experiment abovementioned, of the drop ſuffered to cool, will determine the degree of hardneſs or ſoftneſs that may be ſuitable to the ſeaſon when it is uſed.

Preparation of the hard varniſh uſed by Callot, commonly called the Florence varniſh. Take four ounces of fat oil very clear, and made of good linſeed oil, like that uſed by painters: heat it in a clean pot of glazed earthen-ware, and afterwards put to it four ounces of maſtich well powdered; and ſtir the mixture briſkly till the whole be well melted; then paſs the whole maſs through a piece of fine linen into a glaſs bottle with a long neck, that can be ſtopped very ſecurely; and keep it for the uſe that will be below explained.

Method of applying the ſoft varniſh to the plate, and of blackening it. The plate being well poliſhed and burniſhed, as alſo cleanſed from all greaſineſs by chalk or Spaniſh white, fix a hand-vice on the edge of the plate where no work is intended to be, to ſerve as a handle for managing it when warm: then put it upon a chafing-diſh, in which there is a moderate fire; obſerving to hold it ſo that it may melt: then cover the whole plate equally with a thin coat of the varniſh; and while the plate is warm, and the varniſh upon it in a fluid ſtate, beat every part of the varniſh gently with a ſmall ball or dauber made of cotton tied up in taffety; which operation ſmoothes and diſtributes the varniſh equally over the plate.

When the plate is thus uniformly and thinly covered with the varniſh, it muſt be blackened by a piece of flambeau, or of a large candle which affords a copious ſmoke; ſometimes two, or even four, ſuch candles are uſed together for the ſake of diſpatch, that the varniſh may not grow cold: which if it does during the operation, the plate muſt then be heated again, that it may be in a melted ſtate when that operation is performed: but great care muſt be taken not to burn it; which, when it happens, may be eaſily perceived by the varniſh appearing burnt and loſing its gloſs. The following expedient is made uſe of for the more commodiouſly

blackening.

Etching. blackening the varniſh, being particularly neceſſary where the plates are large: Fix a ſtrong hook in the roof of the room, through which paſs four pieces of cord of equal length, at the end of which are fixed four iron rings of about four inches diameter, for ſupporting the corners of the plate. The plate being thus ſuſpended in the air, with the varniſhed ſide downwards, may be blackened with great convenience: but this is not, however, abſolutely requiſite, except in the caſe of large plates that could not, without difficulty, be held up, unleſs this or ſome other ſuch contrivance were made uſe of.

It is proper to be very cautious in keeping the flambeau or candle at a due diſtance from the plate, leſt the wick touch the varniſh, which would both ſully and mark it. If it appear that the ſmoke has not penetrated the varniſh, the plate muſt be again placed for ſome little time over the chafing-diſh; and it will be found, that, in proportion as the plate grows hot, the varniſh will melt and incorporate with the black which lay above it, in ſuch a manner that the whole will be equally pervaded by it.

Above all things, the greateſt caution ſhould be uſed in this operation, to keep all the time a moderate fire; and to move frequently the plate, and change the place of all the parts of it, that the varniſh may be alike melted everywhere, and kept from burning. Care muſt alſo be taken, that during this time, and even till the varniſh be entirely cold, no filth, ſparks, or duſt, fly on it; for they would then ſtick faſt, and ſpoil the work.

Method of applying the hard varniſh. This is preciſely the ſame as for the ſoft; being ſpread equally over the warm plate with the taffety-ball, and ſmoked in the ſame manner: only after it is ſmoked, it muſt be baked, or dried over a gentle fire of charcoal, till the ſmoke from the varniſh begins to decreaſe; taking care not to overheat the plate, which would both ſoften it and burn the varniſh.

The plate being thus prepared, and an exact drawing of the outlines of the deſign made upon thin paper, the other ſide of the paper muſt be well rubbed with chalk or Spaniſh whitening, or, which is better, with red chalk ſcraped to a powder; and the looſe chalk is cleared off with a linen rag: then the ſtained ſide of the paper is laid upon the varniſh, fixing the corners to the plate with wax or wafers, to prevent its ſhuffling; and with a blunted needle or pointer the drawing is ſlightly traced, and communicates to the varniſh an exact outline of the deſign to be etched.

A variety of pointers is neceſſary for the work. Thoſe uſed for the broad large ſtrokes ought to be very blunt, exceeding round, and well poliſhed at the point; the ſole of a ſhoe anſwers very well for poliſhing the points. The fineſt ought to be as ſharp as a needle. If any ſcratches or falſe ſtrokes happen in the working, they are to be ſtopped up with a hair-pencil dipped in Venetian varniſh, mixed with lamp-black, by which means theſe places will be defended from the action of the aquafortis.

The next operation is that of eating or corroding the plate with aquafortis; in order to which, a border of ſoft wax (being a compoſition of bees wax melted and tempered with a little Venice turpentine and tallow) muſt be faſtened round the plate about an inch high, in the form of a little wall or rampart, to contain the aquafortis. At one of the corners of this border a gutter is uſually made, which ſerves for pouring commodiouſly the aquafortis off the plate. The plate being thus bordered, take a due quantity of the refiners aquafortis; mix it with half its quantity of common water; and pour it gently on, till it riſe above a finger's breadth above the ſurface of the plate; when, if all things have been rightly conducted, it will be ſeen that the aquafortis will ſoon exert its action in the hatches which have been ſtrongly touched; but thoſe more weakly engraved will appear at firſt clear, and of the colour of the copper. The menſtruum muſt therefore be ſuffered to continue on the plate till its effects become viſible on the more tender parts: then the aquafortis ſhould be poured off, the plate waſhed with clean water, and dried before the fire: then take a ſmall pencil dipped into the Venetian varniſh, and cover with it the lighter parts of the plate. This being done, the aquafortis muſt again be poured on, and ſuffered to continue a longer or ſhorter time, according to the ſtrength of the menſtruum, or the nature of the engraving; when it muſt be again poured off as before and the plate immediately waſhed with water.

Etching || Eteocles.

It may not be improper to obſerve, that, when the aquafortis is on the plate, a feather ſhould be uſed to cleanſe away the foulneſs of the verdegris that gathers in the hatches when the aquafortis operates on them, and to give it more room to exert its action; for by moving the aquafortis to and fro on the plate by the feather, and bruſhing away the black ſalme matter where it appears to be formed, the hatches will be cleanſed, and the aquafortis exert its whole force equally on every part.

The plate being thus ſufficiently corroded by the aquafortis, and well waſhed with water, it muſt be warmed at the fire, and the border of wax removed; after which, it muſt be made hotter till the varniſh melt; then it muſt be well wiped with a linen cloth, and afterwards rubbed heartily with oil of olives; when it will be ready to be retouched and finiſhed by the graver. See the article ENGRAVING.

ETEOCLES, in fabulous hiſtory, a ſon of Œdipus and Jocaſta. After his father's death, it was agreed between him and his brother Polynices, that they ſhould both ſhare the royalty, and reign alternately each a year. Eteocles by right of ſeniority firſt aſcended the throne; but after the firſt year of his reign was expired he refuſed to give up the crown to his brother, according to their mutual agreement. Polynices, reſolved to puniſh ſuch an open violation of a ſolemn engagement, went to implore the aſſiſtance of Adraſtus king of Argos. He received that king's daughter in marriage, and was ſoon after aſſiſted with a ſtrong army headed by ſeven famous generals. Theſe hoſtile preparations were ſeen by Eteocles, who on his part did not remain inactive. He choſe ſeven brave chiefs to oppoſe the ſeven leaders of the Argives, and ſtationed them at the ſeven gates of the city. He placed himſelf againſt his brother Polynices, and he oppoſed Menalippus to Tydeus, Polyphontes to Capaneus, Megareus to Eteoclus, Hyperbius to Parthenopæus, and Laſthenes to Amphiaraus. Much blood was ſhed in fight and unavailing ſkirmiſhes, and it was at laſt agreed between the two

brothers

Eternity ‖ Etfu

brothers that the war ſhould be decided by ſingle combat. They both fell in an engagement conducted with the moſt inveterate fury on either ſide; and it is even ſaid that the aſhes of theſe two brothers, who had been ſo inimical one to the other, ſeparated themſelves on the burning pile, as if ſenſible of reſentment, and hoſtile to reconciliation.

ETERNITY, an attribute of God, expreſſing his infinite or endleſs duration. See LOGIC and METAPHYSICS.

ETERNITY, in *Mythology*, a divinity among the Romans, who had neither temples nor altars. They repreſented it under the figure of a woman, who held the ſun in one hand and the moon in the other: her ſymbols were a phœnix, globe, and elephant.

ETESIÆ, or ETESIAN *winds*, are ſuch as blow at ſtated times of the year, from what part ſoever of the compaſs they come. They are ſo called from the Greek word ἔτος, "year," being yearly or anniverſary winds, ſuch as our ſeamen call *monſoons* and *trade-winds*, which in ſome parts of the world continue conſtantly blowing for certain ſtated ſeaſons of the year. Thus, the north winds, which, during the dog-days, conſtantly blow upon the coaſts of Egypt, and hinder all ſhips from ſailing out of Alexandria for that ſeaſon, are called *eteſiæ* in Cæſar's Commentaries. In other authors, the weſt and eaſt winds are called *eteſiæ*, when they continue blowing for certain ſeaſons of the year.

Cellarius endeavours to prove that thoſe winds are properly eteſian which blow from that part of the horizon which is between the north and weſt about the time of the ſolſtice. In ancient writers, they are repreſented as of a very mild and gentle nature; and were called by mariners *ſomniculoſi* and *delicati*, from their ſleeping or ceaſing to blow in the night.

ETFU, a town of Upper Egypt, celebrated on account of the ſublime temple of Apollinopolis, which, Denon obſerves,* is "the moſt beautiful of all Egypt, and, next to thoſe of Thebes, the largeſt. Being built (he adds) at a period when the arts and ſciences had acquired all their ſplendour, the workmanſhip of every part is equally beautiful, the hieroglyphics are admirably executed, the figures more varied, and the architecture of a higher order than in the Theban edifices, the building of which muſt be referred to an earlier age. My firſt care was to take a general plan of the building.

* *Trav.* ii. 277.

"Nothing can be more ſimply beautiful than theſe outlines, nothing more pictureſque than the effect produced in the elevation, by the various dimenſions belonging to each member of the harmonious whole. This ſuperb edifice is ſeated on a riſing ground, ſo as to overlook not only its immediate vicinity, but the whole valley; and at the foot of this greater temple, but on a conſiderably lower level, is a ſmaller one, at preſent almoſt buried. The only part ſtill viſible is in a hollow ſurrounded with rubbiſh, where may be ſeen a little portico of two columns, and as many pilaſters, a periſtyle, and the ſanctuary of the temple incloſed within a pilaſtered gallery. A ſingle column, with its capital riſing from the ruins, to the height of forty feet above the portico, and the angle of a wall 100 feet beyond, ſhew that there formerly exiſted a court in the front of the temple. It is remarkable of this monument, notwithſtanding the ſkill diſplayed in its conſtruction, that the gates are not exactly in the middle of the ſides. It ſeems to have been dedicated to the evil genius, for the figure of Typhon is ſeen in relief on the four ſides of the plinth, which ſurmounts each of the capitals. The whole frieze, and all the paintings within, appear deſcriptive of Iſis defending herſelf againſt the attacks of this monſter."

Ethelbald ‖ Ethics.

ETHELBALD, ETHELBERT, ETHELRED, ETHELWOLF, } kings of England. } See (Hiſtory of) ENGLAND.

ETHER, ETHERIAL, } See ÆTHER.

ETHERIDGE, SIR GEORGE, a celebrated wit and comic genius in the reigns of Charles II. and James II. deſcended from an ancient family in Oxfordſhire, and born in 1636. He travelled in his youth; and, not being able to confine himſelf to the ſtudy of the law, devoted himſelf to the gayer accompliſhments. His firſt dramatic performance, the Comical Revenge, or Love in a Tub, appeared in 1664, and introduced him to the leading wits of the time: in 1668, he produced a comedy called She would if ſhe could; and, in 1676, he publiſhed his laſt comedy, called the Man of Mode, or Sir Fopling Flutter; which is perhaps the moſt elegant comedy, and contains more of the real manners of high life than any one the Engliſh ſtage was ever adorned with. This piece he dedicated to the beautiful ducheſs of York, in whoſe ſervice he then was; and who had ſo high a regard for him, that when, on the acceſſion of James II. ſhe came to be queen, ſhe procured his being ſent ambaſſador firſt to Hamburgh, and afterwards to Ratiſbon, where he continued till after his majeſty quitted the kingdom. Our author being addicted to certain gay extravagances, had greatly impaired his fortune; to repair which, he paid his addreſſes to a rich widow: but ſhe, being an ambitious woman, had determined not to condeſcend to a marriage with any man who could not beſtow a title upon her; on which account he was obliged to purchaſe a knighthood. None of the writers have exactly fixed the period of Sir George's death, though all ſeem to place it not long after the Revolution. Some ſay, that on this event he followed his maſter King James into France, and died there; but the authors of the Biographia Britannica mention a report, that he came to an untimely death by an unlucky accident at Ratiſbon; for that after having treated ſome company with a liberal entertainment at his houſe there, where he had taken his glaſs too freely, and being, through his great complaiſance, too forward in waiting on his gueſts at their departure, ſtumbled as he was, he tumbled down ſtairs and broke his neck, and ſo fell a martyr to mirth and jollity. As to Sir George's literary character, he certainly was born a poet, and ſeems to have been poſſeſſed of a genius whoſe vivacity needed no cultivation: for we have no proofs of his having been a ſcholar. His works, however, have not eſcaped cenſure on account of that licentiouſneſs which in general runs through them, which renders them dangerous to young unguarded minds; and the more ſo, for the lively and genuine wit with which it is gilded over, and which has therefore juſtly baniſhed them from the purity of the preſent ſtage.

ETHICS, the doctrine of manners, or the ſcience of

Ethiopia || Etmuller.

of moral philoſophy. The word is formed from ἦθος, ἦθη, *mores*, "manners;" by reaſon the ſcope or object thereof is to form the manners. See *Moral Philoſophy*.

ETHIOPIA, an extenſive region of Africa. See Abyssinia.

ETHIOPS, antimonial, martial, and mineral. See Chemistry *Index*.

ETHMOIDES, in *Anatomy*, a bone ſituated in the middle of the baſis of the forehead or os frontis, and at the top of the root of the noſe, filling almoſt the whole cavity of the noſtrils. It has its name from ἦθμος, *cribrum*, "ſieve", and εἶδος, "form," becauſe all ſpongy and porous See Anatomy *Index*.

ETHNARCHA, Ethnarch, (formed of ἔθνος, "nation," and ἀρχὴ, "command)," a governor or ruler of a nation.

There are ſome medals of Herod I. ſurnamed the *Great*, on one ſide whereof is found Ἡρῴδου, and on the other Ἐθναρχου, q. d. *Herod the Ethnarch*. After the battle of Philippi, we read that Antony, paſſing over into Syria, conſtituted Herod and Phaſael his brother tetrarchs, and in that quality committed to them the adminiſtration of the affairs of Judea, (Joſ. Ant. lib. xiv. cap. 23.) Herod therefore had the government of the province before ever the Parthians entered Syria, or before Antigonus's invaſion, which did not happen till ſix or ſeven years after Herod was commander in Galilee, (Joſ. lib. xiv. cap. 24, 25.) Conſequently, Herod was then truly ethnarch, for he can be no otherwiſe denominated; ſo that it muſt have been in that ſpace of time that the medals were ſtruck, which only give him this title: which medals are a confirmation of what we read in hiſtory of the government which that prince was intruſted with before he was raiſed to the royalty.

Joſephus gives Herod the appellation of *tetrarch* in lieu of that of *ethnarch;* but the two terms come ſo near to each other, that it is eaſy to confound them together.

Though Herod the Great left by will to Archelaus all Judea, Samaria, and Idumea, yet Joſephus tells us he was then only called *ethnarch*.

ETHNOPHRONES, in antiquity, a ſect of heretics in the ſeventh century, who made a profeſſion of Chriſtianity, but joined thereto all the ceremonies and follies of Paganiſm, as judicial aſtrology, ſortileges, auguries, and other divinations.

ETIQUETTE, a French term, primarily denoting a ticket or title affixed to a bag or bundle of papers, expreſſing its contents. It is alſo uſed, when applied to the Spaniſh and ſome other courts, to ſignify a particular account of what is to be done daily in the king's houſehold, and in the chief ceremonies relating to it. It likewiſe denotes thoſe forms that regulate the decorum of conduct towards perſons of various ranks and ſtations.

ETMULLER, Michael, a moſt eminent phyſician, born at Leipſic in 1646. After having travelled through the greateſt part of Europe, he became profeſſor of botany, chemiſtry, and anatomy, at Leipſic, where he died in 1683. He was a very voluminous writer, his works making no leſs than 5 vols folio, as printed at Naples in 1728. His ſon Michael Erneſt Etmuller was alſo an ingenious phyſician, who publiſhed ſeveral pieces, and died in 1732.

ETNA, or Ætna, a famous burning mountain of Sicily, and the largeſt in Europe. See Ætna. Etna || Etolia.

ETOLIA, a country of ancient Greece, comprehending all that tract now called the *Deſpotat*, or *Little Greece*. It was parted on the eaſt by the river Evenus, now the Fidari, from the Locrenſes Ozolæ; on the weſt, from Acarnania by the Achelous; on the north, it bordered on the country of the Dorians and part of Epirus; and, on the ſouth, extended to the bay of Corinth.

The Etolians were a reſtleſs and turbulent people; ſeldom at peace among themſelves, and ever at war with their neighbours; utter ſtrangers to all ſenſe of friendſhip or principles of honour; ready to betray their friends upon the leaſt proſpect of reaping any advantage from their treachery: in ſhort, they were looked upon by the other ſtates of Greece no otherwiſe than as outlaws and public robbers. On the other hand, they were bold and enterpriſing in war; inured to labour and hardſhips; undaunted in the greateſt dangers; jealous defenders of their liberties, for which they were, on all occaſions, willing to venture their lives, and ſacrifice all that was moſt dear to them. They diſtinguiſhed themſelves above all the other nations of Greece, in oppoſing the ambitious deſigns of the Macedonian princes; who, after having reduced moſt of the other ſtates, were forced to grant them a peace upon very honourable terms. The conſtitution of the Etolian republic was copied from that of the Achæans, and with a view to form, as it were, a counter alliance; for the Etolians bore an irreconcileable hatred to the Achæans, and had conceived no ſmall jealouſy at the growing power of that ſtate. The Cleomenic war, and that of the allies, called the *ſocial war*, were kindled by the Etolians in the heart of Peloponneſus, with no other view but to humble their antagoniſts the Achæans. In the latter, they held out, with the aſſiſtance only of the Eleans and Lacedemonians, for the ſpace of three years, againſt the united forces of Achaia and Macedon; but were obliged at laſt to purchaſe a peace, by yielding up to Philip all Acarnania. As they parted with this province much againſt their will, they watched all opportunities of wreſting it again out of the Macedonian's hands; for which reaſon they entered into an alliance with Rome againſt him, and proved of great ſervice to the Romans in their war with him: but growing inſolent upon account of their ſervices, they made war upon the Romans themſelves. By that warlike nation they were overcome, and granted a peace on the following ſevere terms: 1. The majeſty of the Roman people ſhall be revered in all Etolia. 2. Etolia ſhall not ſuffer the armies of ſuch as are at war with Rome to paſs through her territories, and the enemies of Rome ſhall be likewiſe the enemies of Etolia. 3. She ſhall, in the ſpace of 100 days, put into the hands of the magiſtrates of Corcyra all the priſoners and deſerters ſhe has, whether of the Romans or their allies, except ſuch as have been taken twice, or during her alliance with Rome. 4. The Etolians ſhall pay down in ready money, to the Roman general in Etolia, 200 Euboic talents, of the ſame value as the Athenian talents, and engage to pay 50 talents more within the ſix years following. 5. They ſhall put into the hands of the conſul

Etolia. ſul 40 ſuch hoſtages as he ſhall chooſe; none of whom ſhall be under 12, or above 40 years of age: the prætor, the general of the horſe, and ſuch as have been already hoſtages at Rome, are excepted out of this number. 6. Etolia ſhall renounce all pretenſions to the cities and territories which the Romans have conquered, though thoſe cities and territories had formerly belonged to the Etolians. 7. The city of Oenis, and its diſtrict, ſhall be ſubject to the Acarnanians.

After the conqueſt of Macedon by Paulus Æmilius, they were reduced to a much worſe condition; for not only thoſe among them, who had openly declared for Perſeus, but ſuch as were only ſuſpected to have favoured him in their hearts, were ſent to Rome, in order to clear themſelves before the ſenate. There they were detained, and never afterwards ſuffered to return into their native country. Five hundred and fifty of the chief men of the nation were barbarouſly aſſaſſinated by the partiſans of Rome, for no other crime but that of being ſuſpected to wiſh well to Perſeus. The Etolians appeared before Paulus Æmilius in mourning habits, and made loud complaints of ſuch inhuman treatment; but could obtain no redreſs: nay, ten commiſſioners, who had been ſent by the ſenate to ſettle the affairs of Greece, enacted a decree, declaring, that thoſe who were killed had ſuffered juſtly, ſince it appeared to them that they had favoured the Macedonian party. From this time thoſe only were raiſed to the chief honours and employments in the Etolian republic who were known to prefer the intereſt of Rome to that of their country; and as theſe alone were countenanced at Rome, all the magiſtrates of Etolia were the creatures and mere tools of the Roman ſenate. In this ſtate of ſervile ſubjection they continued till the deſtruction of Corinth, and the diſſolution of the Achæan league; when Etolia, with the other free ſtates of Greece, was reduced to a Roman province, commonly called the *province of Achaia*. Nevertheleſs, each ſtate and city was governed by its own laws, under the ſuperintendency of the prætor whom Rome ſent annually into Achaia. The whole nation paid a certain tribute, and the rich were forbidden to poſſeſs lands anywhere but in their own country.

In this ſtate, with little alteration, Etolia continued under the emperors, till the reign of Conſtantine the Great, who, in his new partition of the provinces of the empire, divided the weſtern parts of Greece from the reſt, calling them *New Epirus*, and ſubjecting the whole country to the *præfectus prætorii* for Illyricum. Under the ſucceſſors of Conſtantine, Greece was parcelled out into ſeveral principalities, eſpecially after the taking of Conſtantinople by the Weſtern princes. At that time, Theodorus Angelus, a noble Grecian, of the imperial family, ſeized on Etolia and Epirus. The former he left to Michael his ſon; who maintained it againſt Michael Palæologus, the firſt emperor of the Greeks, after the expulſion of the Latins. Charles, the laſt prince of this family, dying in 1430 without lawful iſſue, bequeathed Etolia to his brother's ſon, named alſo *Charles*; and Acarnania to his natural ſons, Memnon, Turnus, and Hercules. But, great diſputes ariſing about this diviſion, Amurath II. after the reduction of Theſſalonica, laid hold of ſo favourable an opportunity, and drove them all out in 1432. The Mahometans were afterwards diſpoſſeſſed of this country by the famous prince of Epirus, George Caſtriot, commonly called *Scanderbeg*; who, with a ſmall army, oppoſed the whole power of the Ottoman empire, and defeated thoſe barbarians in 22 pitched battles. That hero, at his death, left great part of Etolia to the Venetians; but, they not being able to make head againſt ſuch a mighty power, the whole country was ſoon reduced by Mahomet II. whoſe ſucceſſors hold it to this day. Eton.

ETON, a town of Bucks, ſituated on the river Thames, acroſs which there is a bridge leading to Windſor. Eton has been long celebrated for its ſchool and college, which were founded by Henry VI.; and King's college in the univerſity of Cambridge admits none into the number of its fellows, who have not been brought up at Eton. It lies weſt from London, at the diſtance of about 20 miles.

The ſcholars of Eton ſchool have a feſtival which has been celebrated from time immemorial, called the *Montem*, the obſervance of which was at firſt biennial, but is now triennial, on the *Whit Tueſday in every third year*. It commences by a number of the older boys taking poſt on the bridges, and guarding every other avenue around Windſor and Eton, as ſoon as the day begins to dawn.

They are generally ſelected on account of their fine figures and ſuperior activity. Their dreſſes are all fanciful, compoſed of ſilks, ſatins, &c. ſome of them very richly embroidered, and chiefly in the appearance of running footmen, having poles in their hands, and denominated *ſalt-bearers*, who demand ſalt of every paſſenger they meeet, by which they mean a contribution, and peremptorily inſiſt on receiving it. The contribution being given, which conſiſts of whatever the perſon pleaſes to beſtow, a printed paper is delivered, containing their motto, together with the date of the year; and this being produced to any other ſalt-bearer, exempts the paſſenger from the payment of any farther contributions during that day. The motto is,

> "*Pro more et monte.*
> *Vivant rex et regina.*"

They continue levying contributions in this manner from the dawn of day till about three o'clock in the afternoon, at which time the proceſſion cloſes. It commences at noon, and conſiſts of the queen's and other bands of muſic;—ſeveral ſtandards carried by different ſtudents;—all the boys of Eton, two and two, dreſſed in the uniform of officers; thoſe belonging to the king's foundation, wear blue, the reſt ſcarlet uniform, ſwords, &c.—the grand ſtandard bearer;—the captain, or head boy of Eton ſchool;—the lieutenant, or ſecond boy;—his majeſty, attended by the prince of Wales, and other male branches of the royal family on horſeback, with their ſuite;—the queen and princeſſes in coaches, attended by their ſuite;—band of muſic, followed by a great concourſe of the nobility and gentry in their carriages, and on horſeback.

The proceſſion begins in the great ſquare at Eton, proceeding through Eton to Slough, and round to Salthill, where the whole of the boys paſs in review before the king and queen, and aſcend the montem, where an oration is delivered, and the grand ſtandard is diſplayed with much activity and grace by the ſtandard-bearer,

Etruria, Etymology.

er, who is commonly ſelected from among the elder boys. Two extraordinary ſalt-bearers are choſen to wait upon their majeſties, dreſſed in fanciful habits, and decorated in the moſt ſuperb manner, carrying an embroidered bag, not only for the purpoſe of receiving what is denominated the *royal ſalt*, but alſo what may be collected by the other ſalt-bearers in different quarters. The donation of the king is 50 guineas, the queen's is the ſame ſum; that of the prince of Wales is 30, and that of the other princes and princeſſes is 20 guineas each. This ceremony being over, the royal family return to Windſor. A ſumptuous entertainment is provided for the boys at the tavern at Salt-hill, and the beautiful gardens are laid out for ladies and gentlemen to take refreſhments, where bands of muſic are conſtantly performing.

At ſix o'clock in the evening, the boys return in the ſame order of proceſſion as in the morning (but without the royal family), and after marching round the great ſquare, are diſmiſſed. After this the captain pays his reſpects to the royal family at the queen's lodge, Windſor, prior to his departure for King's college, Cambridge; to defray the expences of which, he is preſented with the produce of the montem, which in the year 1796 amounted to more than 1000 guineas.

This joyful day is terminated by a brilliant exhibition of beauty, rank, and faſhion; a promenade on the terrace of Windſor; bands of muſic performing, &c.: and the ſcene is rendered ſtill more intereſting and delightful by the humble, affable deportment of the royal family, who readily mingle with the company, and walk on the terrace till it is almoſt dark.

ETRURIA. See HETRURIA.

ETYMOLOGY, that part of grammar which conſiders and explains the origin and derivation of words, in order to arrive at their firſt and primary ſignification, whence Quintilian calls it *originatio*.—The word is formed of the Greek, ετυμος, *verus*, "true," and λεγω, *dico*, "I ſpeak;" whence λογια, *diſcourſe*, &c. and thence Cicero calls the etymology *notatio* and *veriloquium*; though Quintilian chooſes rather to call it *originatio*.

A judicious inquiry into etymologies is thought by ſome of conſiderable uſe; becauſe nations, who value themſelves upon their antiquity, have always looked on the antiquity of their language as one of the beſt titles they could plead; and the etymologiſt, by ſeeking the true and original reaſon of the notions and ideas fixed to each word and expreſſion, may often furniſh an argument of antiquity, from the traces remaining thereof, compared with the ancient uſes. Add, that etymologies are neceſſary for the thorough underſtanding of a language. For, to explain a term preciſely, there ſeems a neceſſity for recurring to its firſt impoſition, in order to ſpeak juſtly and ſatisfactorily thereof. The force and extent of a word is generally better conceived when a perſon knows its origin and etymology.

It is objected, however, that the art is arbitrary, and built altogether on conjectures and appearances; and the etymologiſts are charged with deriving their words from where they pleaſe. And indeed it is no eaſy matter to go back into the ancient Britiſh and Gauliſh ages, and to follow, as it were, by the track, the various imperceptible alterations a language has undergone from age to age; and as thoſe alterations have ſometimes been merely owing to caprice, it is eaſy to take a mere imagination or conjecture for a regular analogy: ſo that it is no wonder the public ſhould be prejudiced againſt a ſcience which ſeems to ſtand on ſo precarious a footing. It muſt certainly be owned, that etymologies are frequently ſo far fetched, that one can ſcarcely ſee any reſemblance or correſpondence therein. Quintilian has ſhown, that the ancient etymologiſts, notwithſtanding all their learning, fell into very ridiculous derivations.

Evacuants || Evangeliſts.

The etymologies of our Engliſh words have been derived from the Saxon, Welch, Walloon, Daniſh, Latin, Greek, &c.

In the preſent work the etymologies of terms are generally noted, where their obviouſneſs does not render it unneceſſary, or their dubiety or unimportance uſeleſs.

EVACUANTS, in *Pharmacy*, are properly ſuch medicines as diminiſh the animal fluids, by throwing out ſome morbid or redundant humour; or ſuch as thin, attenuate, and promote the motion and circulation thereof.

EVACUATION, in *Medicine*, the art of diminiſhing, emptying, or attenuating, the humours of the body.

EVAGRIUS SCHOLASTICUS, a famous hiſtorian, born at Epiphania, about the year 536. He practiſed the profeſſion of an advocate, from which he was called *Scholaſticus*, which name was then given to the pleaders at the bar. He was alſo tribune and keeper of the prefect's diſpatches. He wrote an eccleſiaſtical hiſtory, which begins where Socrates and Theodoret ended theirs; and other works, for which he was rewarded by the emperors Tiberius and Mauricius. M. de Valois publiſhed at Paris a good edition of Evagrius's eccleſiaſtical hiſtory, in folio; and it was republiſhed at Cambridge in 1620, in folio, by William Reading, with additional notes of various authors.

EVANDER, a famous Arcadian chief, called the ſon of Mercury, on account of his eloquence, brought a colony of his people into Italy, about 60 years before the taking of Troy; when Faunus, who then reigned over the Aborigenes, gave him a large extent of country, in which he ſettled with his friends. He is ſaid to have taught the Latins the uſe of letters, and the art of huſbandry. He kindly received Hercules when he returned from the conqueſt of Geryon, and he was the firſt who raiſed him altars. He gave Æneas aſſiſtance againſt the Rutuli, and diſtinguiſhed himſelf by his hoſpitality. It is ſaid that he firſt brought the Greek alphabet into Italy, and introduced there the worſhip of the Greek deities. He was honoured as a god after death, and his ſubjects raiſed him an altar on Mount Aventine.

EVANGELISTS, the inſpired authors of the goſpels. The word is derived from the Greek ευαγγελιον, formed of ευ, *bene*, "well," and αγγελος, "angel or meſſenger."

The denomination *evangeliſts* was likewiſe given in the ancient church to ſuch as preached the goſpel up and down, without being attached to any particular church, being either commiſſioned by the apoſtles to inſtruct the nations, or of their own accord abandoning every worldly attachment, and conſecrating themſelves

to

Evanid ‖ Eucharift.

to the ſacred office of preaching the goſpel. In which ſenſe ſome interpreters think it is that St Philip, who was one of the ſeven deacons, is called the *evangeliſt*, in the 21ſt chapter of the Acts of the Apoſtles, ver. 8. Again, St Paul writing to Timothy, ep. ii. cap. iv. ver. 5. bids him do the work of an evangeliſt. The ſame apoſtle, Eph. iv. 11. ranks the evangeliſts after the apoſtles and prophets.

EVANID, a name given by ſome authors to ſuch colours as are of no long duration, as thoſe in the rainbow, in clouds before and after ſunſet, &c.

Evanid colours are alſo called *fantaſtical* and *emphatical* colours.

EVANTES, in antiquity, the prieſteſſes of Bacchus, thus called, becauſe in celebrating the orgia they ran about as if diſtracted, crying, *Evan, evan, ché evan.* See BACCHANALIA.

EVAPORATION, in *Natural Philoſophy*, ſignifies the converſion of fluids, principally water, into vapour, ſo that it becomes ſpecifically lighter than the atmoſphere. See CHEMISTRY and METEOROLOGY *Index*.

EVASION, in *Law*, is uſed for any ſubtle endeavour to ſet aſide truth, or to eſcape the puniſhment of the law, which will not be endured. Thus, if a perſon ſays to another that he will not ſtrike him, but will give him a pot of ale to ſtrike him firſt, and accordingly he ſtrikes, the returning of it is puniſhable; for no man ſhall evade the juſtice of the law by ſuch a pretence to cover his malice.

EVATES, a branch or diviſion of the druids, or ancient Celtic philoſophers. Strabo divides the Britiſh and Gauliſh philoſophers into three ſects; bards, evates, and druids. He adds, that the bards were the poets and muſicians; the evates, the prieſts and naturaliſts; and the druids were moraliſts as well as naturaliſts: But Marcellus and Hornius reduce them all to two ſects, viz. the BARDS and DRUIDS.

EUBAGES, an order of prieſts or philoſophers among the ancient Celtæ or Gauls: ſome will have the eubages to be the ſame with the druids and saronidæ of Diodorus; and others, that they were the ſame with what Strabo calls EVATES.

EUBŒA, in *Ancient Geography*, an oblong iſland, ſtretching out between Attica and Theſſaly, oppoſite to Bœotia; from which it is ſeparated by a narrow ſtrait called *Euripus*. This iſland, never exceeding 40, nor ever falling ſhort of two miles in breadth, is in length 150 miles, and in compaſs 365, according to Pliny. Now NEGROPONT, from its principal town, which was anciently called *Chalcis*.

EUCHARIST, the ſacrament of the Lord's ſupper, properly ſignifies *giving thanks*.—The word in its original Greek, Ευχαριστια, literally imports *thankſgiving*; being formed of ευ, *bene*, "well," and χαριν, *gratia*, "thanks."

This ſacrament was inſtituted by Chriſt himſelf; and the participation of it is called *communion*.

As to the manner of celebrating the euchariſt among the ancient Chriſtians, after the cuſtomary oblations were made, the deacon brought water to the biſhops and preſbyters, ſtanding round the table, to waſh their hands; according to that of the pſalmiſt, "I will waſh my hands in innocency, and ſo will I compaſs thy altar, O Lord." Then the deacon cried out aloud, "Mutually embrace and kiſs each other;" which being done, the whole congregation prayed for the univerſal peace and welfare of the church, for the tranquillity and repoſe of the world, for the proſperity of the age, for wholeſome weather, and for all ranks and degrees of men. After this followed mutual ſalutations of the miniſter and people; and then the biſhop or preſbyter having ſanctified the elements by a ſolemn benediction, he brake the bread, and delivered it to the deacon, who diſtributed it to the communicants, and after that the cup. Their ſacramental wine was uſually diluted or mixed with water. During the time of adminiſtration, they ſang hymns and pſalms; and having concluded with prayer and thankſgiving, the people ſaluted each other with a kiſs of peace, and ſo the aſſembly broke up. Euchites ‖ Eucholo-gium.

EUCHITES, or EUCHITÆ, a ſect of ancient heretics, who were firſt formed into a religious body towards the end of the fourth century, though their doctrine and diſcipline ſubſiſted in Syria, Egypt, and other eaſtern countries, before the birth of Chriſt; they were thus called becauſe they prayed without ceaſing, imagining that prayer alone was ſufficient to ſave them. Their great foundation were thoſe words of St Paul, (Theſſalonians v. 17.), *Pray without ceaſing*. The word is formed of the Greek, ευχη, *prayer*, whence ευχεται, the ſame with the Latin, *precatores*, "prayers." They were alſo called *Enthuſiaſts* and *Meſſalians*; a term of Hebrew origin, denoting the ſame as Euchites.

The Euchites were a ſort of myſtics, who imagined, according to the oriental notion, that two ſouls reſided in man, the one good and the other evil; and who were zealous in expelling the evil ſoul or demon, and haſtening the return of the good ſpirit of God, by contemplation, prayer, and ſinging of hymns. They alſo embraced the opinions nearly reſembling the Manichean doctrine, and which they derived from the tenets of the oriental philoſophy. The ſame denomination was uſed in the 12th century, to denote certain fanatics who infeſted the Greek and eaſtern churches, and who were charged with believing a double Trinity, rejecting wedlock, abſtaining from fleſh, treating with contempt the ſacraments of baptiſm and the Lord's ſupper, and the various branches of external worſhip, and placing the eſſence of religion ſolely in external prayer, and maintaining the efficacy of perpetual ſupplications to the ſupreme Being for expelling an evil being or genius, which dwelt in the breaſt of every mortal. This ſect is ſaid to have been founded by a perſon called *Lucopetrus*, whoſe chief diſciple was named *Tychicus*. By degrees it became a general and invidious appellation for perſons of eminent piety and zeal for genuine Chriſtianity, who oppoſed the vicious practices and inſolent tyranny of the prieſthood; much in the ſame manner as the Latins comprehended all the adverſaries of the Roman pontiff under the general terms of WALDENSES and ALBIGENSES.

St Cyril of Alexandria, in one of his letters, takes occaſion to cenſure ſeveral monks in Egypt, who, under pretence of reſigning themſelves wholly to prayer, led a lazy, ſcandalous life. A cenſure likewiſe applicable to monaſteries in general.

EUCHOLOGIUM, Ευχολογιον, a Greek term, ſignifying literally *a diſcourſe on prayer*. The word is formed of ευχη, *prayer*, and λογος, *diſcourſe*.

The Euchologium is properly the Greek ritual, wherein are preſcribed the order and manner of every

Euclid || Eudoſia.

thing relating to the order and adminiſtration of their ceremonies, ſacraments, ordinations, &c.

F. Goar has given us an edition of the Greek Euchologium in Greek and Latin, with notes, at Paris.

EUCLID *of* MEGARA, a celebrated philoſopher and logician, flouriſhed about 400 B. C. The Athenians having prohibited the Megareans from entering their city on pain of death, this philoſopher diſguiſed himſelf in women's clothes to attend the lectures of Socrates. After the death of Socrates, Plato and other philoſophers went to Euclid at Megara, to ſhelter themſelves from the tyrants who governed Athens. Euclid admitted but one chief good; which he ſometimes called *God*, ſometimes *Spirit*, and ſometimes *Providence*.

EUCLID *of Alexandria*, the celebrated mathematician, flouriſhed in the reign of Ptolemy Lagus, about 277 B. C. He reduced all the fundamental principles of pure mathematics, which had been delivered down by Thales, Pythagoras, Eudoxus, and other mathematicians before him, into regularity and order, and added many others of his own diſcovering; on which account he is ſaid to be the firſt who reduced arithmetic and geometry into the form of a ſcience. He likewiſe applied himſelf to the ſtudy of mixed mathematics, and eſpecially to aſtronomy, in which he alſo excelled. The moſt celebrated of his works is his Elements of Geometry, of which there have been a great number of editions in all languages; and a fine edition of all his works was printed in 1703, by David Gregory, Savilian profeſſor of aſtronomy at Oxford.

EUCRASY, (of ευ, *well*, and κρασις, *temperature*), in *Medicine*, an agreeable well-proportioned mixture of qualities, whereby a body is ſaid to be in good order, and diſpoſed for a good ſtate of health.

EUDIOMETER, an inſtrument for aſcertaining the purity of the atmoſpherical air, or the quantity of pure oxygen or vital air contained in it, chiefly by means of its diminution, or the abſorption of it by expoſing certain ſubſtances to its action. Several kinds of theſe have been invented. See CHEMISTRY *Index*.

EUDOSIA, (ATHENIA, before her converſion to Chriſtianity), a celebrated lady, the daughter of Leontius, a philoſopher of Athens; who gave her ſuch a learned education, that at his death, he left her only a ſmall legacy, ſaying ſhe was capable to make her own fortune: but pleading at Athens without ſucceſs againſt her two brothers, for a ſhare in her father's eſtate, ſhe carried her cauſe perſonally by appeal to Conſtantinople; recommended herſelf to Pulcheria, the ſiſter of the emperor Theodoſius the younger; embraced Chriſtianity, was baptized by the name of *Eudoſia*, and ſoon after married to the emperor. Their union laſted a conſiderable time: but a difference at laſt taking place, on account of the emperor's jealouſy, excited by Chryſapius the eunuch, ſhe retired to Jeruſalem, where ſhe ſpent many years in building and adorning churches and in relieving the poor. Dupin ſays, that ſhe did not return thence till after the emperor's death: but Cave tells us, that ſhe was reconciled to him, returned to Conſtantinople, and continued with him till his death; after which ſhe went again to Paleſtine, where ſhe ſpent the remainder of her life in pious works. She died in the year 460, according to Dupin; or 459, according to Cave: the latter obſerves, that on her deathbed ſhe took a ſolemn oath, by which ſhe declared herſelf entirely free from any ſtains of unchaſtity. She was the author of a paraphraſe on the eight firſt books of the Old Teſtament in heroic verſe; and of a great number of poems, which are loſt.

Eudoxians || Evelyn.

EUDOXIANS, a party or ſect of heretics in the fourth century, ſo denominated from their leader Eudoxius, patriarch of Antioch and Conſtantinople, a great defender of the Arian doctrine. The Eudoxians adhered to the errors of the Arians and Eunomians, maintaining, that the Son was created out of nothing; that he had a will diſtinct and different from that of the Father, &c.

EVE. See VIGIL.

EVE, the mother of all mankind; who being deluded by the ſerpent, occaſioned the fall, and all its diſmal conſequences. See ADAM.

EVELYN, JOHN, a moſt learned and ingenious writer and natural philoſopher, was born at Wotton in Surry, the ſeat of his father, in 1620. After making the tour of Europe, he returned to England about the year 1651, and lived very retired at his rural retreat, Say's Court, near Deptford in Kent; where his diſguſt at the violence and confuſion of the times operated ſo far upon his ſtudious diſpoſition, that he actually propoſed to Mr Boyle the eſtabliſhing a kind of college for perſons of the ſame turn of mind, where they might aſſociate together without care or interruption. It was owing to Mr Evelyn's gratitude to the place of his education, that Oxford became poſſeſſed of the famous Arundelian marbles; which he perſuaded the Lord Henry Howard to beſtow on that univerſity. He was very aſſiduous in tranſmitting to the Royal Society whatever fell within the compaſs of his inquiries; and uſed humbly to ſtyle himſelf *a pioneer in the ſervice*. When the number of books he publiſhed is conſidered, the many he left behind him unfiniſhed and unpubliſhed, and the variety of ſubjects on which he employed his time, his induſtry and application are aſtoniſhing. "His life (ſays the honourable Mr Walpole) was a courſe of inquiry, ſtudy, curioſity, inſtruction, and benevolence. The works of the Creator, and the mimic labours of the creature, were all objects of his purſuit. He unfolded the perfections of the one, and aſſiſted the imperfections of the other. He adored from examination; was a courtier that flattered only by informing his prince, and by pointing out what was worthy for him to countenance; and was really the neighbour of the Goſpel, for there was no man that might not have been the better for him. He was one of the firſt promoters of the Royal Society, a patron of the ingenious and indigent, and peculiarly ſerviceable to the lettered world; for, beſides his writings and diſcoveries, he obtained the Arundelian marbles for the univerſity of Oxford, and the Arundelian library for the Royal Society: nor is it the leaſt part of his praiſe, that he who propoſed to Mr Boyle the erection of a philoſophic college for retired and ſpeculative perſons, had the honeſty to write in defence of active life againſt Sir George Mackenzie's Eſſay on Solitude. He knew that retirement in his own hands was induſtry and benefit to mankind; but in thoſe of others, lazineſs and inutility." There are five ſmall prints of this gentleman's journey from Rome to Naples, drawn and etched by him; and among his publiſhed works are, 1. A Character of England; 2. The State of France; 3. An Eſſay on the

Evergetes II Evelham.

the firſt book of Lucretius *De rerum natura*: 4. The French gardener; 5. A Panegyric on King Charles II's coronation; 6. *Fumifugum*, or the inconvenience of the air and ſmoke of London diſſipated; 7. The Hiſtory and Art of Engraving on Copper; 8. A parallel between the ancient architecture and the modern; 9. Sylva, or a diſcourſe of foreſt trees; and ſeveral others. This amiable gentleman died, full of age and honour, in 1706. His ſon John Evelyn, born in 1654, diſtinguiſhed himſelf by his elegant tranſlations and poems: He was one of the commiſſioners of the revenue in Ireland; but died early in life, in 1698.

EVERGETES, a ſurname ſignifying *benefactor*, given to Philip of Macedon, and to Antigonus Doſon, and Ptolemy of Egypt. It was alſo commonly given to the kings of Syria and Pontus, and we often ſee among the former an Alexander Evergetes, and among the latter a Mithridates Evergetes. Some of the Roman emperors alſo claimed that epithet of Benevolent and Humane.

EVERGREEN, in *Gardening*, a ſpecies of perennials, which continue their verdure, leaves, &c. all the year: ſuch are hollies, phillyreas, lauriſtinuſes, bays, pines, firs, cedars of Lebanon, &c.

EVERLASTING PEA. See LATHYRUS, BOTANY *Index*.

EVES-DROPPERS. See *EAVES-Droppers*.

EVESHAM, or EVESHOLM, commonly called *Eſham*, a town of Worceſterſhire, ſeated on a gentle aſcent from the river Avon, over which there is a bridge of ſeven arches. It is 95 miles from London, 14 miles from Worceſter, and has a harbour for barges. It is an old borough, reckoned the ſecond in the county; and ſends two members to parliament. It had formerly an abbey with a mitred abbot; which abbey when ſtanding was one of the largeſt and moſt ſtately of any in the kingdom. It was governed by a bailiff, till King James I. at the requeſt of his ſon Prince Henry, gave it a charter for a mayor, 7 aldermen, 12 capital burgeſſes, a recorder, and chamberlain, who are all of the common council, with 24 other burgeſſes called aſſiſtants. Four of the aldermen, and the mayer for the time being, are juſtices of the peace; and of oyer and terminer, and of gaol delivery, for all offences in the corporation, except high treaſon; and the corporation has power to try and execute felons within the borough. Here are two pariſh-churches; but the bells of both have been removed to a beautiful old tower which was one of the gates of the abbey. The town is noted for the great victory obtained near it by Prince Edward, afterwards King Edward I. over Simon Montfort, the great earl of Leiceſter, who was killed in the battle. There is an open proſpect from hence of the ſpacious valley called the *vale of Eveſham* or *vale of Glouceſter*, which ſo abounds with the beſt of corn, as well as paſture for ſheep, that it is reckoned the granary of all theſe parts. The vale runs all along the banks of the Avon, from Tewkeſbury to Perſhore, and Stratford in Warkwickſhire, and the river is ſo far navigable. It has a weekly market and four fairs. The market-houſe built by Sir Edward Hobby has its upper apartments uſed by the corporation for a ſeſſions-houſe, and formerly for the aſſizes of the county. There are conſiderable garden grounds around the place, the produce of which ſupplies the adjacent towns.

Eugene II Evil.

EUGENE, FRANCIS, prince of Savoy, deſcended from Carignan, one of the three branches of the houſe of Savoy, and ſon of Eugene Maurice, general of the Swiſs and Griſons, governor of Champagne, and earl of Soiſſons, was born in 1663. Louis XIV. to whom he became afterwards ſo formidable an enemy, thought him ſo unpromiſing a youth, that he refuſed him preferment both in the church and the ſtate, thinking him too much addicted to pleaſure to be uſeful in either. Prince Eugene, in diſguſt, quitted France; and, retiring to Vienna, devoted himſelf to the Imperial ſervice. The war between the emperor and the Turks afforded the firſt opportunity of exerting his military talents; and every campaign proved a new ſtep in his advancement to the higheſt offices in the army. He gave the Turks a memorable defeat at Zenta; commanded the German forces in Italy, where he foiled Marſhal Villeroy in every engagement, and at length took him priſoner. Our limits do not allow a detail of his campaigns; but Prince Eugene diſtinguiſhed himſelf greatly, when the emperor and Queen Anne united againſt the exorbitant power of Louis XIV. He died at Vienna in the year 1736; and was as remarkable for his modeſty and liberality, as for his abilities in the field and the cabinet.

EUGENIA, the YAMBOO: A genus of plants, belonging to the icoſandria claſs; and in the natural method ranking under the 19th order, *Heſperideæ*. See BOTANY *Index*.

EVICTION, in *Law*, ſignifies a recovery of lands or tenements by law.

EVIDENCE, that perception of truth which ariſes either from the teſtimony of the ſenſes or from an induction of reaſon.

EVIDENCE, in *Law*, ſignifies ſome *proof* by teſtimony of men upon oath, or by writings or records. It is called *evidence*, becauſe thereby the point in iſſue in a cauſe to be tried is to be made *evident* to the jury; for *probationes debent eſſe evidentes et perſpicuæ*. The ſyſtem of evidence, as now eſtabliſhed in our courts of common law, is very full, comprehenſive, and refined; far different from, and ſuperior to, any thing known in the middle ages;—as far ſuperior in that as in all other improvements and refinements in ſcience, arts, and manners.

The nature of evidence during the ages of ignorance was extremely imperfect, and the people were incapable of making any rational improvement. Thus it was the imperfection of human reaſon that cauſed the invention and introduction of the ORDEAL, as an appeal to the Supreme Being. As men are unable to comprehend the manner in which the Deity carries on the government of the univerſe, by equal, fixed, and general laws, they are apt to imagine, that in every caſe which their paſſions or intereſt render important in their own eyes, the Supreme Ruler of all ought viſibly to diſplay his power in vindicating innocence, and puniſhing vice.

EVIL, in *Philoſophy*, &c. is either moral or natural. Moral evil is the diſagreement between the actions of a moral agent, and the rule of thoſe actions whatever it is *.—Natural evil is, whatever deſtroys or any way diſturbs the perfection of natural beings: ſuch as blindneſs, diſeaſes, death, &c.

* See *Natural Philoſophy*.

King's Evil, or *Scrophula*. See MEDICINE *Index*.

Evil-Meroduch, the ſon and ſucceſſor of Nebuchadnezzar

Euler. nezzar the great, king of Babylon, ſucceeded to the crown in the year of the world 3443; but governed the kingdom during the indiſpoſition of his father, who, after ſeven years, having recovered his underſtanding, once more aſcended the throne; and, as ſome believe, impriſoned his ſon Evil-Merodach. In this confinement it is ſuppoſed that Evil-Merodach made an acquaintance and friendſhip with Jehoiachim king of Judah, who had been carried to Babylon by Nebuchadnezzar. However that was, it is certain, that, ſoon after his ſucceſſion to the throne, he delivered the king of Judah out of priſon, after a confinement of 37 years, heaped many favours on him, and placed him above all the other kings who were at the court of Babylon, (2 Kings xxv. 27. Jer. lii. 31.) Evil-Merodach reigned but one year, according to the chronology of Archbiſhop Uſher; but Dr Prideaux will have him to have reigned two years; and was ſucceeded by Nerigliſſar his ſiſter's huſband, who having been at the head of a conſpiracy that put him to death, reigned in his ſtead. Others will have it, that this prince was immediately ſucceeded by his ſon BELSHAZZAR.

EULER, LEONARD, profeſſor of mathematics, member of the imperial academy of Peterſburgh, ancient director of the royal academy of Berlin, and fellow of the royal ſociety of London, as alſo correſpondent member of the royal academy of ſciences at Paris, was born at Baſil, April 15. 1707, of reputable parents. The years of his infancy were paſſed in a rural retreat at the village of Richen, of which place his father was miniſter.—Being ſent to the univerſity of Baſil, he attended regularly the different profeſſors. As his memory was prodigious, he performed his academical taſks with uncommon rapidity; and all the time he gained by this was conſecrated to geometry, which ſoon became his favourite ſtudy. The early progreſs he made in this ſcience, only added new ardour to his application; and thus he obtained a diſtinguiſhed place in the attention and eſteem of Profeſſor John Bernouilli, who was at that time one of the firſt mathematicians in Europe. In 1723, M. Euler took his degree as maſter of arts; and delivered on that occaſion a Latin diſcourſe, in which he drew a compariſon between the philoſophy of Newton and the Carteſian ſyſtem, which was received with the greateſt applauſe. He afterwards, at his father's deſire, applied himſelf to the ſtudy of theology, and the oriental languages. Though theſe ſtudies were foreign to his predominant propenſity, his ſucceſs was conſiderable even in this line: however, with his father's conſent, he returned to geometry as his principal object. He continued to avail himſelf of the counſels and inſtructions of M. Bernouilli; he contracted an intimate friendſhip with his two ſons Nicholas and Daniel; and it was in conſequence of theſe connexions that he became afterwards the principal ornament of the academy of Peterſburg. The project of erecting this academy, which had been formed by Peter the Great, was executed by Catherine I,; and the two young Bernouillis being invited to Peterſburg in 1725, promiſed Euler, who was deſirous of following them, that they would uſe their utmoſt endeavours to procure for him an advantageous ſettlement in that city. In the mean time, by their advice, he applied himſelf with ardour to the ſtudy of phyſiology, to which he made a happy application of his mathematical knowledge; and he attended the medical lectures of the moſt eminent profeſſors of Baſil. This ſtudy, however, did not wholly engroſs his time: it did not even relax the activity of his vaſt and comprehenſive mind in the cultivation of other branches of natural ſcience. For while he was keenly engaged in phyſiological reſearches, he compoſed A Diſſertation on the Nature and Propagation of Sound, and an anſwer to a prize queſtion concerning the maſting of ſhips; to which the academy of ſciences adjudged the *acceſſit*, or ſecond rank, in the year 1727. From this latter diſcourſe, and other circumſtances, it appears that Euler had early embarked in the curious and important ſtudy of navigation, which he afterwards enriched with ſo many valuable diſcoveries. Euler.

M. Euler's merit would have given him an eaſy admiſſion to honourable preferment, either in the magiſtracy or univerſity of his native city, if both civil and academical honours had not been there diſtributed by lot. The lot being againſt him in a certain promotion, he left his country, ſet out for Peterſburg, and was made joint profeſſor with his countrymen Meſſrs Hermann and Daniel Bernouilli in the univerſity of that city. At his firſt ſetting out in his new career, he enriched the academical collection with many memoirs, which excited a noble emulation between him and the Bernouillis: and this emulation always continued, without either degenerating into a ſelfiſh jealouſy, or producing the leaſt alteration in their friendſhip. It was at this time that he carried to new degrees of perfection the integral calculus, invented the calculation of ſinuſes, reduced analytical operations to a greater ſimplicity, and thus was enabled to throw new light on all the parts of mathematical ſcience. In 1730, he was promoted to the profeſſorſhip of natural philoſophy; and in 1733 he ſucceeded his friend D. Bernouilli in the mathematical chair. In 1735, a problem was propoſed by the academy which required expedition, and for the ſolution of which ſeveral eminent mathematicians had demanded the ſpace of ſome months. The problem was ſolved by Euler in three days, to the great aſtoniſhment of the academy; but the violent and laborious efforts it coſt him threw him into a fever, which endangered his life, and deprived him of the uſe of his right eye. The academy of ſciences at Paris, which in 1738 had adjudged the prize to his memoir Concerning the Nature and Properties of Fire, propoſed for the year 1740 the important ſubject of the ſea tides; a problem whoſe ſolution required the moſt arduous calculations, and comprehended the theory of the ſolar ſyſtem. Euler's diſcourſe on this queſtion was adjudged a maſterpiece of analyſis and geometry; and it was more honourable for him to ſhare the academical prize with ſuch illuſtrious competitors as Colin Maclaurin and Daniel Bernouilli, than to have carried it away from rivals of leſs magnitude. Rarely, if ever, did ſuch a brilliant competition adorn the annals of the academy; and no ſubject, perhaps, propoſed by that learned body was ever treated with ſuch accuracy of inveſtigation and force of genius, as that which here diſplayed the philoſophical powers of theſe three extraordinary men.

In the year 1741, M. Euler was invited to Berlin to augment the luſtre of the academy, that was there riſing

Euler. rising into fame. He enriched the laſt volume of the miſcellanies (*melanges*), of Berlin with five memoirs, which make an eminent, perhaps the principal, figure in that collection. Theſe were followed with an aſtoniſhing rapidity by a great number of important reſearches, which are ſcattered through the memoirs of the Pruſſian academy; of which a volume has been regularly publiſhed every year ſince its eſtabliſhment in 1744. The labours of Euler will appear more eſpecially aſtoniſhing, when it is conſidered, that while he was enriching the academy of Berlin with a prodigious number of memoirs, on the deepeſt parts of mathematical ſcience, containing always ſome new points of view, often ſublime truths, and ſometimes diſcoveries of great importance; he did not diſcontinue his philoſophical contributions to the academy of Peterſburgh, which granted him a penſion in 1742, and whoſe memoirs diſplay the marvellous fecundity of Euler's genius. It was with much difficulty that this great man obtained, in 1766, permiſſion from the king of Pruſſia to return to Peterſburgh, where he deſired to paſs the reſt of his days. Soon after his return, which was graciouſly rewarded by the munificence of Catherine II. he was ſeized with a violent diſorder, which terminated in the total loſs of his ſight. A cataract, formed in his left eye, which had been eſſentially damaged by a too ardent application to ſtudy, deprived him entirely of the uſe of that organ. It was in this diſtreſſing ſituation that he dictated to his ſervant, a tailor's apprentice, who was abſolutely devoid of mathematical knowledge, his elements of algebra; which by their intrinſical merit, in point of perſpicuity and method, and the unhappy circumſtances in which they were compoſed, have equally excited applauſe and aſtoniſhment. This work, though purely elementary, diſcovers the palpable characteriſtics of an inventive genius; and it is here alone that we meet with a complete theory of the analyſis of Diophantus.

About this time M. Euler was honoured by the Academy of Sciences at Paris with the place of one of the foreign members of that learned body; and, after this, the academical prize was adjudged to three of his memoirs, Concerning the Inequalities in the Motions of the Planets. The two prize queſtions propoſed by the ſame academy for 1770 and 1772 were deſigned to obtain from the labours of aſtronomers a more perfect theory of the moon. M. Euler, aſſiſted by his eldeſt ſon, was a competitor for theſe prizes, and obtained them both. In this laſt memoir, he reſerved for farther conſideration ſeveral inequalities of the moon's motion, which he could not determine in his firſt theory, on account of the complicated calculations in which the method he then employed had engaged him. He had the courage afterward to review his whole theory, with the aſſiſtance of his ſon and Meſſrs Krafft and Lexell, and to purſue his reſearches until he had conſtructed the new tables, which appeared, together with the great work, in 1772. Inſtead of confining himſelf as before, to the fruitleſs integration of three differential equations of the ſecond degree, which are furniſhed by mathematical principles, he reduced them to the three ordinates, which determine the place of the moon; he divided into claſſes all the inequalities of that planet, as far as they depend either on the elongation of the ſun and moon, or upon the eccentricity, or the parallax, or the inclination of the lunar orbit. All theſe means of inveſtigation, employed with ſuch art and dexterity as could only be expected from analytical genius of the firſt order, were attended with the greateſt ſucceſs; and it is impoſſible to obſerve, without admiration, ſuch immenſe calculations on the one hand, and on the other the ingenious methods employed by this great man to abridge them, and to facilitate their application to the real motion of the moon. But this admiration will become aſtoniſhment, when we conſider at what period and in what circumſtances all this was effectuated by M. Euler. It was when he was totally blind, and conſequently obliged to arrange all his computations by the ſole powers of his memory and his genius. It was when he was embarraſſed in his domeſtic circumſtances by a dreadful fire, that had conſumed great part of his ſubſtance, and forced him to quit a ruined houſe, of which every corner was known to him by habit, which, in ſome meaſure, ſupplied the place of ſight. It was in theſe circumſtances that Euler compoſed a work, which, alone, was ſufficient to render his name immortal. The heroic patience and tranquillity of mind which he diſplayed here, needs no deſcription: and he derived them not only from the love of ſcience, but from the power of religion. His philoſophy was too genuine and ſublime to ſtop its analyſis at mechanical cauſes; it led him to that divine philoſophy of religion which ennobles human nature, and can alone form a habit of true magnanimity and patience in ſuffering. Euler.

Some time after this, the famous Wenzell, by couching the cataract, reſtored M. Euler's ſight; but the ſatisfaction and joy that this ſucceſsful operation produced, were of ſhort duration. Some inſtances of negligence on the part of his ſurgeons, and his own impatience to uſe an organ, whoſe cure was not completely finiſhed, deprived him of his ſight a ſecond time; and this relapſe was accompanied with tormenting pain. He, however, with the aſſiſtance of his ſons, and of Meſſrs Krafft and Lexell, continued his labours; neither the loſs of his ſight, nor the infirmities of an advanced age, could damp the ardour of his genius. He had engaged to furniſh the academy of Peterſburgh with as many memoirs as would be ſufficient to complete its acts for 20 years after his death. In the ſpace of ſeven years he tranſmitted to the academy by Mr Golſwin, above 70 memoirs, and above 200 more, which were reviſed and completed by the author of this paper. Such of theſe memoirs as were of ancient date were ſeparated from the reſt, and form a collection that was publiſhed in the year 1783, under the title of *Analytical Works*.

Euler's knowledge was more univerſal than could be well expected in one who had purſued with ſuch unremitting ardour mathematics and aſtronomy as his favourite ſtudies. He had made a very conſiderable progreſs in medical, botanical, and chemical ſcience. What was ſtill more extraordinary, he was an excellent ſcholar, and poſſeſſed what is generally called *erudition* in a very high degree. He had, read with attention and taſte, the moſt eminent writers of ancient Rome; the civil and literary hiſtory of all ages and all nations was familiar to him; and foreigners, who were only acquainted with his works, were aſtoniſhed to find

Eulogy || Eumenes.

find in the converſation of a man, whoſe long life ſeemed ſolely occupied in mathematical and phyſical reſearches and diſcoveries, ſuch an extenſive acquaintance with the moſt intereſting branches of literature. In this reſpect, no doubt, he was much indebted to a very uncommon memory, which ſeemed to retain every idea that was conveyed to it, either from reading or from meditation. He could repeat the Æneid of Virgil, from the beginning to the end, without heſitation, and indicate the firſt and laſt line of every page of the edition he uſed.

Several attacks of a vertigo, in the beginning of September 1783, which did not prevent his calculating the motions of the aeroſtatical globes, were, nevertheleſs, the forerunners of his mild and happy paſſage from this ſcene to a better. While he was amuſing himſelf at tea with one of his grandchildren, he was ſtruck with an apoplexy, which terminated his illuſtrious career at the age of 76. His conſtitution was uncommonly ſtrong and vigorous; his health was good; and the evening of his long life was calm and ſerene, ſweetened by the fame that follows genius, the public eſteem and reſpect that are never withheld from exemplary virtue, and ſeveral domeſtic comforts which he was capable of feeling and therefore deſerved to enjoy.

EULOGY, EULOGIA, in church hiſtory. When the Greeks have cut a loaf or piece of bread to conſecrate it, they break the reſt into little bits, and diſtribute it among the perſons who have not yet communicated, or ſend it to perſons that are abſent; and theſe pieces of bread are what they call *eulogies*. The word is Greek, ευλογια, formed of ευ, *bene*, "well," and λεγω, *dico*, "I ſay, ſpeak;" q. d. *benedictum*, "bleſſed."

The Latin church has had ſomething like eulogies for a great many ages; and thence aroſe the uſe of their holy bread.

The name *eulogy* was likewiſe given to loaves or cakes brought to church by the faithful to have them bleſſed.

Laſtly, The uſe of the term paſſed hence to mere preſents made to a perſon without any benediction. See the Jeſuit Gretſer, in his treatiſe *de Benedictionibus et Maledictionibus*, lib. ii. cap. 22, 24, &c. where he treats of eulogies thoroughly.

From a paſſage in Bolandus, on the life of St Melaine, cap. 4. it appears, that eulogies were not only of bread, but any kind of meat bleſſed and hallowed for that purpoſe. Add, that almoſt every body bleſſed and diſtributed eulogies; not only biſhops and prieſts, but even hermits, though laymen, made a practice of it. Women alſo would ſometimes ſend eulogies.

The wine ſent as a preſent was alſo held an eulogy. Bolandus remarks farther, that the euchariſt itſelf was alſo called *eulogy*.

EULOGY, likewiſe means an encomium on any perſon, on account of ſome virtue or good quality.

EUMARIDES, of ευμαρης, "eaſy," among the ancients, a kind of ſhoes common to men and women.—The eumarides were uſed for pomp and delicacy, being neat, and painted with various colours.

EUMENES, a Greek officer in the army of Alexander, ſon of a charioteer. He was the moſt worthy of all the officers of Alexander to ſucceed after the death of his maſter. He conquered Paphlagonia, and Cappadocia, of which he obtained the government, till the power and jealouſy of Antigonus obliged him to retire. He joined his forces to thoſe of Perdiccas, and defeated Craterus and Neoptolemus. Neoptolemus periſhed by the hands of Eumenes. When Craterus had been killed during the war, his remains received an honourable funeral from the hand of the conqueror; and Eumenes, after weeping over the aſhes of a man who was once his deareſt friend, ſent his remains to his relations in Macedonia. Eumenes fought againſt Antipater and conquered him; and after the death of Perdiccas his ally, his arms were directed againſt Antigonus, by whom he was conquered A. U. C. 433, chiefly by the treacherous conduct of his officers. This fatal battle obliged him to diſband the greateſt part of his army to ſecure himſelf a retreat; and he fled with only 700 faithful attendants to a fortified place on the confines of Cappadocia, called *Nora*, where he was ſoon beſieged by the conqueror. He ſupported the ſiege for a year with courage and reſolution, but ſome diſadvantageous ſkirmiſhes ſo reduced him, that his ſoldiers, grown deſperate, and bribed by the offers of the enemy, had the infidelity to betray him into the hands of Antigonus. The conqueror, from ſhame or remorſe, had not the courage to viſit Eumenes; but when he was aſked by his officers, in what manner he wiſhed him to be kept, he anſwered, keep him as carefully as you would keep a lion. This ſevere command was obeyed; but the aſperity of Antigonus vaniſhed in a few days, and Eumenes, delivered from the weight of chains, was permitted to enjoy the company of his friends. Even Antigonus heſitated whether he ſhould not reſtore to his liberty a man with whom he had lived in the greateſt intimacy while both ſubſervient to the command of Alexander; and theſe ſecret emotions of pity and humanity were not a little increaſed by the petitions of his ſon Demetrius for the releaſe of Eumenes. But the calls of ambition prevailed; and when Antigonus recollected what an active enemy he had in his power, he ordered Eumenes to be put to death in the priſon. His bloody commands were executed 315 years before the Chriſtian era. Such was the end of a man who raiſed himſelf to power by merit alone. His ſkill in public exerciſes firſt recommended him to the notice of Philip; and under Alexander, his attachment and fidelity to the royal perſon, and particularly his military accompliſhments, promoted him to the rank of a general. Even his enemies revered him; and Antigonus, by whoſe orders he periſhed, honoured his remains with a ſplendid funeral, and conveyed his aſhes to his wife and family in Cappadocia. It has been obſerved, that Eumenes had ſuch a univerſal influence over the ſucceſſors of Alexander, that none during his lifetime dared to aſſume the title of king.

Eumenes.

EUMENES I. king of Pergamus, who ſucceeded his uncle Philetærus about 264 years before Chriſt. He made war againſt Antiochus the ſon of Seleucus, and enlarged his poſſeſſions by ſeizing upon many of the cities of the kings of Syria. He lived in alliance with the Romans, and made war againſt Pruſias king of Bithynia. He was a great patron of learning; but being much given to wine, he died of an exceſs in drinking, after a reign of 22 years. He was ſucceeded by Attalus.

Eumenes || Eumolpides

EUMENES II. ſucceeded his father Attalus on the throne of Aſia and Pergamus. His kingdom was ſmall and poor, but he rendered it powerful and opulent; and his alliance with the Romans did not a little contribute to the increaſe of his dominions after the victories obtained over Antiochus the Great. He carried his arms againſt Pruſias and Antigonus; and died 160 years before Chriſt, after a reign of 40 years, leaving the kingdom to his ſon Attalus II. He has been admired for his benevolence and magnanimity; and his love of learning greatly enriched the famous library of Pergamus, which had been founded by his predeceſſors in imitation of the Alexandrian collection of the Ptolemies. His brothers were ſo attached to him and devoted to his intereſt, that they enliſted among his body guards to ſhow their fraternal fidelity.

EUMENES, a celebrated orator of Athens about the beginning of the fourth century. Some of his harangues and orations are extant. An hiſtorical writer in Alexander's army.

EUMENIDES, a name given to the Furies by the ancients. They ſprang from the blood of the wound which Cœlus received from his ſon Saturn. According to others, they were daughters of Earth, and conceived from the blood of Saturn. Some make them daughters of Acheron and Night, or Pluto and Proſerpine. According to the more received opinions, they were three in number, Tiſiphone, Megara, and Alecto, to which ſome add Nemeſis. Plutarch mentions only one called *Adraſta*, daughter of Jupiter and Neceſſity. They were ſuppoſed to be the miniſters of the vengeance of the gods. They were ſtern and inexorable; and were always employed in puniſhing the guilty upon earth, as well as in the infernal regions. They inflicted their vengeance upon earth by wars, peſtilence, and diſſenſions, and by the ſecret ſtings of conſcience; and in hell they puniſhed the guilty by continual flagellation and torments. They were alſo called *Furiæ* and *Erinnys*. Their worſhip was almoſt univerſal; and people dared not to mention their names or fix their eyes upon their temples. They were honoured with ſacrifices and libations; and in Achaia they had a temple, which when entered by any one guilty of a crime, ſuddenly rendered him furious and deprived him of the uſe of his reaſon. In the ſacrifices the votaries uſed branches of cedar and of alder, hawthorn, ſaffron, and juniper; and the victims were generally turtle doves and ſheep, with libations of wine and honey. They were uſually repreſented with a grim and frightful aſpect, with a black and bloody garment, and with ſerpents writhing round their heads inſtead of hair. They held a burning torch in one hand, and a whip of ſcorpions in the other; and were always attended by Terror, Rage, Paleneſs, and Death. In hell they were ſeated around Pluto's throne, as the miniſters of his vengeance.

EUMENIDIA, feſtivals in honour of the Eumenides, called by the Athenians σεμναι θεαι, "venerable goddeſſes." They were celebrated once every year, with ſacrifices of pregnant ewes, with offerings of cakes made by the moſt eminent youths, and libations of honey and wine. At Athens none but freeborn citizens were admitted, ſuch as had led a life the moſt virtuous and unſullied.

EUMOLPIDES, the prieſts of Ceres at the celebration of her feſtivals at Eleuſis. They were deſcended from Eumolpus, a king of Thrace, who was made prieſt of Ceres by Erechtheus king of Athens. He became ſo powerful after his appointment to the prieſthood, that he maintained a war againſt Erechtheus. This war proved fatal to both. Erechtheus and Eumolpus were both killed, and peace was re-eſtabliſhed among their deſcendants, on condition that the prieſthood ever remained in the houſe of Eumolpus, and the regal power in the family of Erechtheus. The prieſthood remained in the family of Eumolpus for 1200 years; and this is ſtill more remarkable, becauſe he who was once appointed to the holy office was obliged to remain in perpetual celibacy. Eumolpus || Eunomians

EUMOLPUS, a king of Thrace, ſon of Neptune and Chione. He was thrown into the ſea by his mother, who wiſhed to conceal her ſhame from her father. Neptune ſaved his life and carried him into Æthiopia, where he was brought up by a woman, one of whoſe daughters he married. An act of violence to his ſiſter-in-law obliged him to leave Æthiopia, and he fled to Thrace with his ſon Iſmarus, where he married the daughter of Tegyrius the king of the country. This connexion to the royal family rendered him ambitious; he conſpired againſt his father-in-law, and fled, when the conſpiracy was diſcovered, to Attica, where he was initiated in the myſteries of Ceres of Eleuſis, and made hierophantes or high prieſt. He was afterwards reconciled to Tegyrius, and inherited his kingdom. He made war againſt Erechtheus king of Athens, who had appointed him to the office of high prieſt, and periſhed in battle about 1380 years before the Chriſtian era. His deſcendants were alſo inveſted with the prieſthood, which remained for about 1200 years in that family.

EUNAPIUS, a native of Sardis in Lydia, a celebrated ſophiſt, phyſician, and hiſtorian, who flouriſhed in the 4th century, under the emperors Valentinian, Valens, and Gratian. He wrote "The Lives of the Philoſophers and Sophiſts," in which he frequently ſhows himſelf a bitter enemy to the Chriſtians: alſo a "Hiſtory of the Cæſars," which he deduced from the reign of Claudius where Herodian left off, down to that of Arcadius and Honorius. The hiſtory is loſt; but we have the ſubſtance of it in Zoſimus, who is ſuppoſed to have done little more than copy it.

EUNOMIANS, in church hiſtory, Chriſtian heretics in the 4th century. They were a branch of Arians, and took their name from Eunomius biſhop of Cyzicus, whoſe confeſſion of faith here follows, extracted from Cave's *Hiſtoria Literaria*, vol. i. p. 223. "There is one God, uncreated and without beginning; who has nothing exiſting before him, for nothing can exiſt before what is uncreated; nor with him, for what is uncreated muſt be one; nor in him, for God is a ſimple and uncompounded being. This one ſimple and eternal being is God, the creator and ordainer of all things; firſt indeed and principally of his only-begotten Son; and then, through him, of all other things. For God begot, created, and made, the Son, only by his direct operation and power, before all things, and every other creature; not producing, however, any being like himſelf, or imparting any of his own proper ſubſtance to the Son: For God is immortal, uniform, indiviſible; and therefore cannot communicate any part

Eunomius, Eunuch.

of his own proper ſubſtance to another. He alone is unbegotten; and it is impoſſible that any other being ſhould be formed of an unbegotten ſubſtance. He did not uſe his own ſubſtance in begetting the Son, but his will only: nor did he beget him in the likeneſs of his ſubſtance, but according to his own good pleaſure. He then created the Holy Spirit, the firſt and greateſt of all ſpirits, by his own power indeed and operation mediately, yet by the immediate power and operation of the Son. After the Holy Spirit he created all other things in heaven and in earth, viſible and inviſible, corporeal and incorporeal, mediately by himſelf, by the power and operation of the Son," &c.

EUNOMIUS, a famous hereſiarch of the 4th century, the diſciple of Elius, but abundantly more ſubtile than his maſter, as well as more bold in propagating the opinions of his ſect, who after him are called *Eunomians*. He was ordained biſhop of Cyzicus; but gave ſo much diſturbance by the intemperance of his zeal, that he was depoſed more than once. At laſt, tired with being toſſed about, he petitioned to retreat to the place of his birth, Dacora in Cappadocia; where he died very old about the year 374, after experiencing a variety of ſufferings. The greateſt part of his works are loſt. There is, however, beſides two or three ſmall pieces, a confeſſion of his faith remaining, which Cave inſerted in his *Hiſtoria Literaria*, from a manuſcript in Archbiſhop Tenniſon's library. See the preceding article.

EUNUCH, a caſtrated perſon. See the article CASTRATION.—The word is formed from ευνην εχει, q. d. *lecti curam habet*, "guardian or keeper of the bed."

In Britain, France, &c. eunuchs are never made but upon occaſion of ſome diſeaſe, which renders ſuch an operation neceſſary; but in Italy they make great numbers of children, from one to three years of age, eunuchs, every year, to ſupply the operas and theatres of all Europe with ſingers. M. de la Lande, in his *Voyage d'Italie*, aſſerts, that there are public ſhops at Naples where this cruel operation is performed, and that over the door of theſe ſhops is inſcribed *Qui ſi caſtrano ragazzi*. But Dr Burney informs us, that he was not only utterly unable to ſee or hear of any ſuch ſhops during his reſidence in that city, but was conſtantly told, both by the natives and Engliſh ſettled there, that the laws againſt ſuch a practice were ſo numerous and ſevere, that it was never performed but with the utmoſt ſecrecy.

In the eaſtern parts of the world, they make eunuchs in order to be guards or attendants on their women. The ſeraglios of the eaſtern emperors are chiefly ſerved and guarded by eunuchs; and yet, from good authority, we learn, that the rich eunuchs in Perſia and other countries keep ſeraglios for their own uſe. Thoſe who, out of an imprudent zeal to guard themſelves from ſenſual pleaſures, made themſelves eunuchs, were, by the council of Nice, condemned and excluded from holy orders. There are ſeveral ſevere prohibitions in Germany againſt the making of eunuchs; and in France an eunuch muſt not marry, not even with the conſent of the woman.

Though the practice of caſtration is deteſtable in every point of view; yet there appears no real foundation for the injurious opinion generally entertained of eunuchs, viz. that they are all cowards, and devoid of genius for literature or any ſolid ſtudy. "As to genius (ſays the author laſt quoted), I never found thoſe of the firſt claſs in muſic deficient in intellectual abilities for more ſerious ſtudies. Indeed I have ſeen real genius and diſpoſitions for literary purſuits, in more than one great opera ſinger; and as for compoſition, and the theory of muſic, not only the beſt ſingers of the pope's chapel ever ſince the beginning of the laſt century, but the beſt compoſers, are among the ſoprani in that ſervice." With reſpect to the operation affecting the mind ſo much as to deprive it of all fortitude in times of danger, there is great reaſon to doubt the fact: moſt of the generals of eaſtern monarchs having been at all times of this claſs; and the braveſt ſtand that ever was made againſt Alexander the Great was at Gaza, under the command of one of Darius's generals, who was an eunuch. Ammianus Marcellinus gives an account of Menophilus, a eunuch, to whom Mithridates intruſted his daughter; which proves the poſſibility of ſuch unfortunate perſons poſſeſſing a heroiſm equal to that of the moſt determined Stoic.

Eunuch || Evocati.

It is very certain, that the ancients never ſuppoſed eunuchs to have been men of inferior intellects, or that they poſſeſſed leſs vigour of mind than other men. At leaſt the Perſians were not of this opinion; for Herodotus * relates, that when they had taken poſſeſſion of ſome Ionian cities, παιδας τε τας εν ηβησκαιδεκα ελεγομενους εξεταμνον, και εποιευν αυτι ειναι ενοχιας συνοχας. It is certain, however, Herodotus †, in relating the melancholy ſtory of Hermotimus, ſays, that παρα τοισι βαρβαροισι τε μαλιστα οι εισι ευνοχοι, πιστιος ενεκα πασης, των ενοχιων, "among the barbarians, the eunuchs are more valued than other men, on account of their univerſal fidelity." It appears from this paſſage of Herodotus, that in Perſia eunuchs were far from being objects of contempt; and were even frequently promoted to the higheſt honours. This was indeed the caſe with Hermotimus. We find in Agathias, who was one of the Byzantine hiſtorians, that a general in the Roman army, named *Narſes*, was a eunuch. This was in the latter ages. In Plutarch's Life of Ariſtides, Themiſtocles is related to have choſen an eunuch, whoſe name was *Arnaces*, from among his priſoners, to ſend on a ſecret embaſſy to Xerxes. This ſurely may ſerve to ſhow, that mental imbecility was not ſuppoſed by the Greeks to be the characteriſtic of eunuchiſm. The ſame ſtory of the confidence placed in Arnaces, who was one of the Perſian king's eunuchs, is related alſo in the life of Themiſtocles. Ariſtotle paid ſuch high reſpect to Hermias, who was a eunuch and governor of Atarnea, which is in Myſia, that he even offered ſacrifices in honour of him; as Lucian informs us in his Dialogue entitled *Eunuchus*. This regard of Ariſtotle for Hermias has been often celebrated, and is mentioned by Suidas, Harpocration, and others.

* Lib. vi. 32. p. 451. Ed. Weſſeling.

† Lib. viii. p. 668.

EUNUCHS, in church hiſtory, a ſect of heretics in the third century, who were mad enough to caſtrate, not only thoſe of their own perſuaſion, but even all others they could lay hold of. They took their riſe from the example of Origen, who, miſunderſtanding the following words of our Saviour, "and eunuchs who made themſelves eunuchs for the kingdom of heaven," caſtrated himſelf.

EVOCATI, ſoldiers among the Romans, who having ſerved their full time in the army, went afterwards volunteers at the requeſt of ſome favourite general; on which

Evocation || Eupatridæ.

which account they were called by the honourable names of *Emeriti* and *Beneficiarii*.

EVOCATION (*Evocatio*), among the Romans, a religious ceremony always observed by them at the undertaking a siege, wherein they solemnly called upon the gods and goddesses of the place to forsake it and come over to them. Without the performance of this ceremony, they either thought that the place could not be taken, or that it would be a sacrilege to take the gods prisoners. They always took it for granted that their prayer was heard, and that the gods had deserted the place and come over to them, provided they were able to make themselves masters of it.

EUODIA, a genus of plants, belonging to the tetrandria class. See BOTANY *Index*.

EVOLUTION, in *Algebra*, the unfolding or opening of a curve, and making it describe an evolvent.—The word *evolutio* is formed of the preposition *è*, "out;" and *volvo*, "I roll, or wind;" q. d. an *unwinding*, or *unrolling*.

The equable evolution of the periphery of a circle, or other curve, is such a gradual approach of the circumference to rectitude, as that its parts do all concur and equally evolve or unbend; so that the same line becomes successively a less arc of a reciprocally greater circle; till at last they change into a straight line. In the Phil. Trans. N° 262, a new quadratrix to the circle is found by this means, being the curve described by the equable evolution of its periphery.

EVOLUTION, is also used for the extraction of roots out of powers; in which sense it stands opposed to involution. See ALGEBRA.

EVOLUTION, in the art of war, the motion made by a body of troops, when they are obliged to change their form and disposition, in order to preserve a post or occupy another, to attack an enemy with more advantage, or to be in a condition of defending themselves the better.

It consists in doublings, counter-marches, conversions, &c. A battalion doubles the ranks, when attacked in front or rear, to prevent its being flanked or surrounded; for then a battalion fights with a larger front. The files are doubled, either to accommodate themselves to the necessity of a narrow ground, or to resist an enemy that attacks them in flank. But if the ground will allow it, conversion is much preferable; because, after conversion, the battalion is in its first form, and opposes the file-leaders, which are generally the best men, to the enemy; and likewise, because doubling the files in a new or not well-disciplined regiment, they may happen to fall into disorder. See DOUBLING.

EVOLVULUS, a genus of plants belonging to the pentandria class; and in the natural method ranking under the 29th order, *Campanaceæ*. See BOTANY *Index*.

EUONYMUS, the SPINDLE TREE; a genus of plants belonging to the pentandria class; and in the natural method ranking under the 43d order, *Dumosæ*. See BOTANY *Index*.

EUPATORIUM, HEMP AGRIMONY; a genus of plants belonging to the syngenesia class; and in the natural method ranking under the 49th order, *Compositæ*. See BOTANY *Index*.

EUPATRIDÆ, in antiquity, a name given by Theseus to the nobility of Athens, as distinguished from the Geomori and Demiurgi. The Eupatridæ, by Theseus's establishment, had the right of choosing magistrates, teaching and dispensing the laws, and interpreting holy and religious mysteries. The whole city, in all other matters, was reduced to an equality. The Geomori were husbandmen, and inferior to the Eupatridæ in point of fortune; the Demiurgi were artificers, and fell short of the Eupatridæ in number.

Euphony || Euphrates.

EUPHONY, in *Grammar*, an easiness, smoothness, and elegance of pronunciation. The word is formed of εὖ, *bene*, "well;" and φωνὴ, *vox*, "voice." Quintilian calls *euphonia*, "*vocalitas*;" Scaliger, "*facilis pronunciatio*."

Euphonia is properly a kind of figure whereby we suppress a too harsh letter, or convert it into a smoother, contrary to the ordinary rules. There are examples enough in all languages.

EUPHYMISM. See ORATORY.

EUPHORBIA, SPURGE; a genus of plants belonging to the dodecandria class; and in the natural method ranking under the 38th order, *Tricoccæ*. See BOTANY *Index*.

EUPHORBIUM, in the *Materia Medica*, a gummi-resinous substance, which exsudes from a large oriental tree, (EUPHORBIA *officinarum*). See MATERIA MEDICA *Index*.

EUPHORBUS, a famous Trojan, son of Panthöus. He was the first who wounded Patroclus, whom Hector killed. He perished by the hand of Menelaus, who hung his shield in the temple of Juno at Argos. Pythagoras, the founder of the doctrine of the metempsychosis or transmigration of souls, affirmed that he had been once Euphorbus, and that his soul recollected many exploits which had been done while it animated that Trojan's body. As a further proof of his assertion, he showed at first sight the shield of Euphorbus in the temple of Juno.

EUPHORION *of* CHALCIS, a poet and historian, born in the 126th Olympiad. Suetonius says that Tiberius composed verses in imitation of Euphorion, Rianius and Parthenius; with whom he was charmed to such a degree, that he ordered their writings and their pictures to be kept in all the public libraries, among the ancient and celebrated authors.

EUPHRASIA, EYE-BRIGHT; a genus of plants belonging to the didynamia class; and in the natural method ranking under the 40th order, *Personatæ*. See BOTANY *Index*.

EUPHRATES, a river universally allowed to take its rise in Armenia Major; but in what particular spot, or in what direction it afterwards shapes its course, there is the greatest disagreement. Strabo says, that the Euphrates rises in Mount Abus, which he joins with, or accounts a part of, Mount Taurus; that its beginning is on the north side of Mount Taurus; and that running, first westward through Armenia, then striking off to the south, it forces its way through that mountain; and thus it rises in the south of Armenia, Mount Taurus being the boundary on that side; and runs through its south part, quite to Cappadocia, conterminal with Armenia Minor; or quite to this last, or to its south limit; to reach which, it must bend its west course a little north; because Taurus, from which it rose, lies lower, or more to the south, and almost parallel with Melitene: and that then it turns to the south, in order

Eupolis, Evremond.

to break through Taurus, and escape to Syria, and then take a new bend to Babylonia. To this account of Strabo, Pliny runs quite counter; adducing eye-witnesses, who carry the Euphrates from north to south in a right line, till it meets Mount Taurus; placing the springs to the east, as Strabo does; whence, he says, it runs in a long course westward, before it bends south; and that it rises not from Mount Taurus, but far to the north of it; and he makes it run straight west from its rise, then turn south spontaneously, without any interposing obstacle, in a manner quite different from Strabo, Mela, and others, who make Taurus the cause of this turn. The Euphrates naturally divides into two channels, one through Babylon, and the other through Seleucia, besides the several artificial cuts made between it and the Tigris about Babylon: and these cuts or trenches are what the Psalmist calls the rivers of Babylon, on the willows of which the captives hung their harps. It is probable, that the Euphrates naturally poured into the sea at one particular mouth, before these cuts were made. A thing appearing so evident to the ancients, that Pliny has set down the distance between the mouths of the Euphrates and the Tigris; and he says, some made it 25, and others 7, miles; but that the Euphrates being for a long time back intercepted in its course by cuts, made for watering the fields, only the branch called the *Pasitigris* fell into the sea, the rest of it into the Tigris, and both together into the Persian gulf. Overflowing the country through which it runs, at stated times of the year, like the Nile, it renders it fertile.

EUPOLIS, an Athenian comic poet, flourished about the 85th Olympiad. He took the freedom of the ancient comedy in lashing the vices of the people. He lost his life in a sea fight between the Athenians and Lacedemonians; and his fate was so much lamented, that after his death it was enacted that no poet should serve in the wars. Some say Alcibiades put him to death for his satirical freedom.

EVREMOND, Charles de St Denis, a polite scholar and soldier, was born at St Denis le Guast in Lower Normandy in 1613. He was intended for the profession of the law, and entered on the study; but he soon quitted it, and was made an ensign before he was 16. A military life did not hinder him from cultivating polite literature; and he signalized himself by his politeness and wit as much as by his bravery. The king made him a mareschal de camp, and gave him a pension of 3000 livres per annum. He served under the duke of Candale in the war of Guienne; and in Flanders, till the suspension of arms was agreed on between France and Spain: he afterwards accompanied Cardinal Mazarine when he went to conclude the peace with Don Lewis de Haro, the king of Spain's first minister. He wrote, as he had promised, a long letter to the marquis de Crequi, of this negotiation; in which he showed, that the cardinal had sacrificed the honour of France to his own private interest, and rallied him in a very satirical manner. This letter falling into the hands of the cardinal's creatures some time after his death, was represented as a state crime, and he was obliged to fly to Holland. He had too many friends in England (whither he had taken a tour the year before with the count de Soissons, sent to compliment Charles II. upon his restoration) to make any long stay in Holland; and therefore passed over into England, where he was received with great respect, and admitted into intimate friendship with several persons of distinction. The king gave him a pension of 300l. a-year. He had a great desire to return to his native country; and, after the peace of Nimeguen, wrote a letter in verse to the king of France to ask leave, but in vain. Upon the death of King Charles, he lost his pension. He did not rely much on King James, though that prince had shown himself extremely kind to him. The Revolution was advantageous to him. King William, who had known him in Holland, gave him substantial marks of his favour. He died of a strangury in 1703, aged 90; and was interred in Westminster abbey, where a monument is erected to his memory. His behaviour was engaging, his humour cheerful, and he had a strong disposition to satire: he professed the Roman religion, in which he was born; but at the bottom was certainly a freethinker. He always spoke of his disgrace with the resolution of a gentleman; and whatever strong desire he had to return to his country, he never solicited the favour with meanness: therefore, when this leave was signified to him unexpectedly in the decline of his life, he replied, that the infirmities of age did not permit him to leave a country where he lived agreeably. There have been many editions of his works: but the best is that of Amsterdam in 1726, in 5 vols. 12mo, to which is prefixed his life by Doctor Des Maizeaux; who has also given an accurate English translation of them in 3 vols. 8vo.

Evremond, Euripides.

EURIPIDES, one of the Greek poets who excelled in tragedy, was born about 468 B. C. in the isle of Salamis, whither his father and mother had retired a little before Xerxes entered Attica. He learnt rhetoric under Prodicus, morality under Socrates, and natural philosophy under Anaxagoras; but at 18 years of age abandoned philosophy, in order to apply himself to dramatic poetry. He used to shut himself up in a cave to compose his tragedies, which were extremely applauded by the Greeks. The Athenian army, commanded by Nicias, being defeated in Sicily, the soldiers purchased their lives and liberties by reciting the verses of Euripides; such esteem and veneration had the Sicilians for the pieces wrote by this excellent poet. Socrates, the wisest of the philosophers, set such a value upon them, that they were the only tragedies he went to see acted; and yet his performances seldom gained the prize. Euripides frequently interspersed through them moral sentences, and severe reflections on the fair sex; whence he was called the *Woman-hater*. He was, nevertheless, married: but the scandalous lives of his two wives drew upon him the raillery of Aristophanes, and other comic poets; which occasioned his retiring to the court of Archelaus, king of Macedon, where he was well received. That prince was fond of learned men, and drew them to him by his liberality. If we may believe Solinus, he made Euripides his minister of state, and gave him other extraordinary proofs of his esteem. He had, however, passed but a few years there, when an unhappy accident put an end to his life. He was walking in a wood, and, according to his usual manner, in deep meditation; when, unfortunately happening upon Archelaus's hounds, he was by them torn in pieces. It is not certain whether

Euripus, Euroclydon

ther his death happened by chance, or through envy of ſome of the great courtiers. However, Archelaus buried him with great magnificence; and the Athenians were ſo much afflicted at his death, that the whole city went into mourning. Of 92 tragedies which he compoſed, only 19 are remaining: the moſt valuable editions of which are thoſe of Aldus, in 1503, 8vo; of Plantin, in 1570, ſexeſimo; of Comelin, in 1597, 8vo; of Paul Stevens, in 1604, 4to; and of Joſhua Barnes, 1694, folio.

EURIPUS, a canal or ſtrait which divides the iſland of Eubœa, now Negropont, from the continent of Greece. In one place it is ſo narrow, that a galley can ſcarcely paſs through it. The agitations of the Euripus were much ſpoken of by the ancients. Some ſay that the canal has a flux and reflux ſix times in 24 hours; others, that it ebbs and flows ſeven times a day; but Livy does not allow this flux and reflux to be ſo regular. Father Babin, a Jeſuit of great learning, who made many obſervations on the ſpot during his long abode in the iſland of Negropont, tells us, that the Euripus is regular in its ebbing and flowing the firſt eight days of the moon: the ſame regularity he obſerved from the 14th to the 20th day inclusive, and in the three laſt days: but in the other days of the lunar month, it is not ſo regular; for it ſometimes ebbs and flows 11, 12, 13, and 14 times in the ſpace of a natural day. In this place, as the ſtory commonly goes, Ariſtotle drowned himſelf out of chagrin, for not being able to account for ſo unuſual a motion.

EURIPUS has ſince become a general name for all ſtraits, where the water is in great motion and agitation.

The ancient circuſes had their euripi, which were no other than pits or ditches on each ſide of the courſe, into which it was very dangerous falling with their horſes and chariots as they ran races. The term *euripus* was more particularly applied by the Romans to three canals or ditches which encompaſſed the circus on three ſides, and which were filled occaſionally to repreſent naumachiæ or ſea battles. The ſame people called their ſmaller fountains or canals in their gardens *euripuſes*; and their largeſt, as caſcades, &c. *niles*.

EUROCLYDON, (of Ευρος, *eaſt wind*, and κλυδων, *wave*,) is a ſpecies of wind, of which we have an account only in Acts xxvii. 14. and concerning the nature of which critics have been much divided. Bochart, Grotius, Bentley, and others, ſubſtitute another reading, ſupported by the Alexandrian MS. and the Vulgate, viz. Ευραχυλων, or *Euro-aquilo*; but Mr Bryant defends the common reading, and conſiders the *Euroclydon*, i. e. Ευρος κλυζων, as an eaſt wind that cauſes a deep ſea or vaſt inundation. He maintains, in oppoſition to Dr Bentley's reaſoning, who ſuppoſes that the mariners in the ſhip, the voyage of which is recited in this paſſage, were Romans, that they were Greeks of Alexandria, and that the ſhip was an Alexandrian ſhip employed in the traffic of carrying corn to Italy; and therefore, that the mariners had a name in their own language for the particular typhonic or ſtormy wind here mentioned. He always ſhows from the paſſage itſelf, that the tempeſtuous wind called *Euroclydon*, beat (κατ' αυλης) upon the iſland of Crete; and therefore, as this is a relative expreſſion, referring to the ſituation of the perſon who ſpeaks of it, who was at that time to the windward or ſouth of it, the wind blew upon ſhore, and muſt have come from the ſouth or ſouth-eaſt; which, he adds, is fully warranted by the point where the ſhip was, and the direction it ran in afterwards, which was towards the north and north-weſt. Europa, Europes

EUROPA, in fabulous hiſtory, a daughter of Agenor king of Phœnicia and Telephaſſa. She was ſo beautiful that Jupiter became enamoured of her; and the better to ſeduce her, he aſſumed the ſhape of a bull and mingled with the herds of Agenor, while Europa, with her female attendants, were gathering flowers in the meadows. Europa careſſed the beautiful animal; and at laſt had the courage to ſit upon his back. The god took advantage of her ſituation; and with precipitate ſteps retired towards the ſhore, croſſed the ſea with Europa on his back, and arrived ſafe in Crete. Here he aſſumed his original ſhape and declared his love. The nymph conſented, though ſhe had once made vows of perpetual celibacy; and ſhe became mother of Minos, Sarpedon, and Rhadamanthus. After this diſtinguiſhed amour with Jupiter, ſhe married Alterius king of Crete. This monarch ſeeing himſelf without children by Europa, adopted the fruit of her amours with Jupiter, and always eſteemed Minos, Sarpedon, and Rhadamanthus, as his own children. Some ſuppoſe, that Europa lived about 1552 years before the Chriſtian era.

EUROPE, one of the four quarters of the world. This is conſiderably the ſmalleſt of the four grand diviſions of the terraqueous globe. Its length, from eaſt to weſt, according to the moſt authentic accounts, meaſures about 3300 miles Britiſh meaſure, and its breadth 2350. The continental part of it is bounded on the ſouth by the Mediterranean ſea, on the weſt by the Atlantic ocean, comprehending the moſt diſtant iſle of Europe, viz. that of Iceland, for Greenland is now conſidered as conſtituting a part of North America. Many geographers of eminence have given the Azores to Europe, from their greater proximity to Portugal than to any other continental country, and have conſidered the Madeiras as a conſtituent part of Africa for a ſimilar reaſon. Europe is bounded on the north by the Arctic ocean and the new land; while its eaſtern limits appear to be more uncertain in the eſtimation of geographers. It appears evident, however, that a very natural limit might be aſcertained by tracing the river Oufa from its ſource to its confluence with the Belaia; and thence from the Kama to the Volga, which would make its diviſion extremely natural to the town of Sarepta; it requiring only an imaginary line of very ſmall extent from that place to the river Don, which would ſatisfactorily aſcertain its weſtern boundary.

The weſtern and ſouthern parts of Europe anciently conſiſted of the people called *Celts*; the Fins occupied the north-eaſt, and the Laplanders, a people equally diminutive with the Samoieds of Aſia, poſſeſſed its remoteſt parts towards the north, who rendered their own language leſs uncouth and barbarous by aſſimilating it to that of the Fins. The Goths from Aſia ſeem to have driven thoſe ancient inhabitants towards the eaſt and north, whoſe deſcendants occupy the greater part of Europe. From the Sclavonic tribes, who alſo came from Aſia, the Poles, Ruſſians, &c. were deſcended. Theſe were accompanied by the Heruli, who made uſe of what is now denominated the Lettic ſpeech, to be

met

Europe. met with in Courland, Livonia, Lithuania, Prussia, and Samogitia, and nearly allied to the Sclavonic language, according to the account of Tooke in his view of Russia. At an early period the colony of Iberi and northern Mauritani, came over into Spain; and at a later period both the Hungarians and Turks emigrated from Asia.

Notwithstanding the high character of d'Anville as a geographer, we believe that his opinion respecting the geographical knowledge of the ancients is greatly exaggerated. It appears evident that nothing more of Scandinavia was known to the ancients than the southern part as far as the lakes of Weter and Wener. It is no doubt true that the Romans, by means of their shipping, even in the imperfect state of navigation at that period, traversed the southern shores of the Baltic, as far as to the river Rubo, ascertaining the names of various tribes along that coast; but if the maps of Ptolemy are admitted as decisive proofs in this case, it is certain that they were wholly unacquainted with the interior of Germany; and consequently the tribes of which he makes mention, may rather be considered as having dwelt along the northern shores of the Baltic, or the southern parts on the left of the Danube. They were no doubt acquainted with the Carpathian mountains; but their knowledge of Europe towards the north-east was undoubtedly circumscribed by the 50th or 52d degree of north latitude.

In many barbarous languages, the same word was often used indiscriminately either for a mountain or a forest, the want of attention to which has frequently been the prolific source of error, and placed mountains of the greatest consequence where the hand of nature had planted trees. It has been supposed that the Riphæan mountains were the Uralian chain, of which the ancients knew nothing, instead of a forest of prodigious extent from east to west. It is also well known that the *Venedici Montes* of Ptolemy have no existence upon earth, and therefore must once have been a very extensive forest with which the moderns are unacquainted, and perhaps no traces of it are now anywhere to be met with.

Christianity is the predominant religion all over Europe, except in Turkey; and even there it has been computed, that about one-half of the inhabitants are members of the Greek church. The Christian religion has always been accompanied in its progress with the diffusion of knowledge, the extension of industry, and the civilization of manners, whereas the barbarous tribes in the northern parts of Europe advanced by very slow degrees, and the Scandinavians continued in a state of pagan ignorance till the eleventh century. Some tribes of Sclavonia to the south of the Baltic, were not converted to Christianity till the thirteenth century, and of course were for many ages in a state little superior to brutality; and the people of Lapland were not converted to the Christian faith till about a century ago, by means of missionaries sent from Denmark. The people of Europe, as to matters of religion, are divided into catholics and protestants, the former being chiefly confined to the southern parts of it, where the imagination requires the gratifications arising from external pomp and parade; and the latter in the northern parts of it, the simplicity of which is much better calculated to please the predominant exercise of the judgment. The Christian religion being thus diffused all over Europe, Europe. that division of the globe has hence become a kind of republic in respect of literature, every scientific invention and discovery being transmitted from one portion of it to another with the utmost dispatch. For this reason Europe has been sometimes compared to ancient Greece, and it is to be hoped that Russia will never prove another Macedon.

The greater part of this quarter of the globe lies within the northern temperate zone, a distinction which is now nearly annihilated by the interesting discoveries of modern geography. Climate is found to depend very frequently on causes which are purely local, since the Alps in a southern latitude, exhibit mountains of ice which are not known even in Lapland, while the torrid zone is plentifully supplied with water and habitations, and for any thing which can be determined to the contrary, it may contain mountains which are covered with snow. As it is happily delivered from those intense heats which are peculiar to Asia and Africa, the inhabitants are in general blessed with greater bodily vigour and intellectual strength.

One of the most striking features of Europe in a general point of view is its inland seas, which give it a decided superiority over the other more extensive divisions of the earth, and contribute powerfully to the extension of its industry, commerce, and civilization. If such blessings had been enjoyed by Africa, it is more than probable that the consequences of her industry would have been diffused far and wide. Of these inland seas, the Mediterranean holds the most distinguished place, as the centre of civilization both to the ancient and modern inhabitants of Europe. It is about 2000 miles in length to its farthest extremity in Syria, but the maps of antiquity made it 500 more. The gulfs of Venice and the Archipelago open on its northern side, formerly denominated the Adriatic and Egean seas, from the last of which there is a communication with the sea of Marmora, or the Propontis, by means of the Hellespont; and the strait of Constantinople leads into the Black sea, to the north of which is the sea of Azof, (Palus Mœotis), or utmost maritime boundary of Europe in that direction. This vast expanse of water is beautifully ornamented with numerous islands and an opulent sea coast, exhibiting delightful specimens of almost every thing in nature which is sublime and beautiful. Tides cannot be perceived except in straits of very small dimensions, although naturalists have observed, that a current sets along the shores of Italy from west to east, while its direction is from east to west towards the coast of Africa. In the gulf of Venice the current runs along Dalmatia in a north-west direction, and returns by the opposite shore of Italy. There is abundance of fish to be met with in the Mediterranean, some of which are but rarely to be found in more northern latitudes. This sea in particular abounds with coral, now certainly known to be the production of marine insects. This imaginary plant is tri-coloured, composed of red, vermilion and white, and does not exceed eleven inches in height. It is hard in the sea, and in this respect undergoes not the smallest change by exposure to the air; and the nets made use of for procuring it, measure from 60 to 125 feet. From the colour of its rocks or perilous navigation, the Black sea is said to have derived its name. As the sea of

EUROPE.
NORTHERN OCEAN
ATLANTIC OCEAN
GERMAN OCEAN
BALTIC
BLACK SEA
MEDITERRANEAN SEA
Arctic Circle
North Cape
Iceland
Faroe Isles
Shetland Isles
Orkney Isles
Scotland
Ireland
Denmark
SWEDEN
NORWAY
RUSSIA
POLAND
GERMANY
FRANCE
SPAIN
PORTUGAL
SWITZERLAND
HUNGARY
TURKEY
Constantinople
Madrid
Lisbon
Paris
London
Berlin
Vienna
Stockholm
Petersburg
Moscow
Warsaw
Naples
Rome
Gibraltar
Malta
Sicily
Sardinia
Corsica
Cyprus
Candia
Jerusalem
Cairo
Algiers
Tripoli
Tunis
Fez
Morocco
PART OF AFRICA
Long. West from London
Longitude
East from London

Europe. Azof almoſt always exhibits a muddy appearance, it was for that reaſon denominated *Palus* by the ancients, and it is united to the Euxine or Black ſea by the ſtrait of Caffa.

The next inland ſea of Europe is the Baltic, to which the Germans have given the name of the Eaſtern ſea, which accounts for the people denominated *Eaſterlings* in the hiſtory of England, who undoubtedly came from the ſhores of the Baltic. It opens from the German ſea by a gulf trending north-eaſt, known by the name of the *Skager Rack*, from whence it paſſes ſouthward in the Cattegat, to the ſouth-eaſt of which we meet with the ſound of Elſinore, where veſſels become in ſome degree tributary to the king of Denmark. It is afterwards divided into two branches of great extent, called the gulfs of Bothnia and Finland, both of which are covered with ice for nearly five months in the year. The greateſt depth of the Baltic is ſaid not to exceed 50 fathoms; and according to the opinion of naturaliſts, its extent ſuffers a diminution of four feet every century. It has been affirmed that its waters do not contain above one-thirtieth of ſalt, while other ſea-waters frequently contain one-tenth, which has been aſcribed to the vaſt quantity of ice; and when the north wind blows, theſe waters, it is alſo ſaid, may be employed for the purpoſes of domeſtic economy. There are no tides in the Baltic, and but very few fiſh.

The White ſea, in the northern parts of Ruſſia, is the laſt inland ſea of Europe, which was well known to the Engliſh in particular, before the commerce of Archangel was transferred to Peterſburgh. It went by the name of *Quen ſea* in the reign of Alfred the Great; and the writers of Iceland called it the ſea of *Ganvick*, on the ſhores of which ſtood their Biarmia. There are a number of iſlands in the White ſea, but the accounts which geographers have hitherto given us, are neither circumſtantial nor ſatisfactory.

The German ſea deſerves to be mentioned among the other maritime diviſions of Europe, which has received this appellation becauſe it waters the weſtern ſhores of ancient Germany, from the Rhine to the fartheſt boundary of Jutland. It may properly be regarded as conſtituting a part of the Atlantic ocean, ending at the ſtraits of Dover, from whence the Britiſh channel extends to the weſt. Another extenſive inlet of the Atlantic is the bay of Biſcay; for the Britiſh channel is rather to be conſidered as the wide frith of the Severn. St George's channel lies on the ſouth between Great Britain and Ireland, and the Iriſh ſea leading to the North channel, is ſituated in the centre. What the ancients called the Deucaledonian ſea, lies to the north of Scotland, which was likewiſe denominated the Sarmatian, as extending throughout the Baltic.

The Arctic ocean lies to the north of Europe, the diſmal receptacle of countleſs miles of ice, piled up in mountains, the hoary majeſty of which, while it captivates the eye, can ſcarcely fail to ſtrike terror into the heart of the mariner. Yet from thoſe dreary regions, which at firſt appear only as a prodigious waſte in the works of creation, the benevolent Parent of the univerſe diffuſes innumerable millions of herrings for the uſe of man. This is worthy of the divine being whoſe goodneſs is whiſpered to us in every breeze, which glows in the ſtarry firmament of heaven, and is diffuſed through the whole creation,

The Goodwin ſands in the vicinity of the Kentiſh coaſt, are as dangerous to the mariner as uninviting to the fiſher; but excellent fiſh are to be found on many banks on the coaſt of Holland, among which may be ranked the cod, the ſoal, and the plaice. What are called the ſilverpits of the mariners, lying between the Dogger and Well bank, ſupply the London market with cod, which diſcovers a predilection for the deep waters in the vicinity of the banks. The Hornriff, a narrow ſtrip extending to Jutland, is ſituated towards the north eaſt of the Dogger bank. The Juttſriff extends from the mouth of the Baltic to the German ſea, in the form of a creſcent. Europe || Euryandra.

The Mar bank takes its riſe oppoſite to Berwick, which is little more than 15 miles in length. To the eaſtward of this lies the Long Forties, extending from Buchanneſs to Newcaſtle, and from between 40 and 100 miles from the ſhore; and a bank reaches acroſs the German ſea towards Juttſriff, from the coaſt of Buchan. It was thought neceſſary, in this conciſe account of Europe, to mention ſome of the moſt conſiderable banks or comparative ſhoals, which have often been regarded as the ſummits of lofty mountains beneath the ſurface of the deep; and which, as the haunts of fiſhes of different ſpecies, have arreſted the attention of national induſtry.

A deſcription of the principal rivers of Europe will be given in our account of the countries through which they reſpectively flow. The greater part of the Wolga is conſidered as belonging to Europe; the next highly celebrated river is the Danube, after which we may rank the Nieper, the Rhine, and the Elbe. The Alps are the loftieſt mountains; next the Pyrenees; and that vaſt ridge by which Norway is divided from Sweden. The Carpathian mountains, the chain called Emineh, and the Apennines, are of inferior magnitude.

The European ſtates and kingdoms may properly be divided into three claſſes; 1. Deſpotic monarchies, of which Ruſſia and Turkey may ſerve as ſpecimens. 2. Abſolute monarchies, ſuch as Spain and Denmark. And 3. Thoſe of a limited nature, as the Germanic empire, and the kingdom of Great Britain. Since the governments of Venice, Switzerland and Holland were ſubverted by the French, few, if any traces of a permanent ariſtocracy are to be met with, or any government in the hands of hereditary nobility. In ſome of the Swiſs cantons we may perhaps find the ſhadow of democracy; and France is at preſent a military deſpotiſm called an empire, the right of ſucceſſion being hereditary indefeaſible.

It is cuſtomary with ſome geographers to divide the conſtituent parts of Europe into firſt, ſecond, and third orders, according to their political importance; the firſt order including the united kingdoms of Great Britain and Ireland, France, Ruſſia, the Auſtrian dominions, Pruſſia, Spain, Turkey. In the ſecond order ſtand the United Provinces, Denmark, Sweden, Portugal and Switzerland; and the chief ſtates of Germany and Italy conſtitute the third, a detailed account of which our readers will find in this work under their proper names.

EURYALE, in *Mythology*, one of the Gorgons, daughter of Phorcys, and ſiſter of Meduſa; ſhe was ſubject neither to old age nor death.

EURYANDRA, a genus of plants belonging to the polyandria claſs. See BOTANY *Index*.

EURYDICE,

Eurydice || Eusebians.

EURYDICE, in fabulous history, the wife of Orpheus, who, flying from Aristæus that endeavoured to ravish her, was slain by a serpent. Her husband went down to the shades, and by the force of his music persuaded Pluto and Proserpine to give him leave to carry back his wife; which they granted, provided he did not look on her till he came to the light: but he breaking the condition, was forced to leave her behind him. See ORPHEUS.

EURYMEDON, in *Ancient Geography*, a noble river running through the middle of Pamphylia; famous for a sea and land fight on the same day, in which the Athenians under Cimon the son of Miltiades, defeated the Persians. The sea fight happened first in the sea of Pamphylia, towards Cyprus; the land engagement, the following night on the Eurymedon. Cimon, after defeating the Persian fleet, armed his men with the armour of the captives, and set sail for the enemy, who lay on the banks of the Eurymedon, in the ships taken from the Persians; who on seeing their own ships and their own people in appearance, were off their guard, and thus became an easy conquest.

EURYSTHEUS, a king of Argos and Mycenæ, son of Sthenelus and Nicippe the daughter of Pelops. Juno hastened his birth by two months, that he might come into the world before Hercules the son of Alcmena, as the younger of the two was doomed by order of Jupiter to be subservient to the will of the other. (See ALCMENA.) This natural right was cruelly exercised by Eurystheus, who was jealous of the fame of Hercules; and who to destroy so powerful a relation, imposed upon him the most dangerous and uncommon enterprises, well known by the name of the *twelve labours of Hercules*. The success of Hercules in atchieving those perilous labours alarmed Eurystheus in a greater degree, and he furnished himself with a brazen vessel, where he might secure himself a safe retreat in case of danger. After the death of Hercules, Eurystheus renewed his cruelties against his children, and made war against Ceyx king of Trachinia, because he had given them support, and treated them with hospitality. He was killed in the prosecution of this war by Hyllus the son of Hercules. His head was sent to Alcmena the mother of Hercules; who, mindful of the cruelties which her son had suffered, insulted it, and tore out the eyes with the most inveterate fury. Eurystheus was succeeded on the throne of Argos by Atreus his nephew. The death of Eurystheus happened about 30 years before the Trojan war.

EURYTHMY, in *Architecture*, *Painting*, and *Sculpture*, is a certain majesty, elegance, and easiness, appearing in the composition of divers members or parts of a body, painting, or sculpture, and resulting from the fine proportion of it.

EUSDEN, LAURENCE, an Irish clergyman, rector of Coneshy in Lincolnshire, and poet laureat after the death of Mr Rowe. His first patron was the eminent Lord Halifax; whose poem, on the battle of the Boyne, he translated into Latin, and dedicated to his lordship. He was esteemed by the duke of Newcastle, who rewarded an epithalamium he wrote on his marriage with the place of poet laureat. He was the author of many poetical pieces, though but little known before his preferment: he died in 1730.

EUSEBIANS, a denomination given to the sect of Arians, on account of the favour and countenance which Eusebius, bishop of Cæsarea, showed and procured for them at their first rise. See ARIANS and EUSEBIUS. Eusebius || Eustathians

EUSEBIUS, surnamed PAMPHILUS, a celebrated bishop of Cæsarea in Palestine, and one of the most learned men of his time, was born in Palestine about the latter end of the reign of Gallienus. He was the intimate friend of Pamphilus the Martyr; and, after his death, took his name in honour to his memory. He was ordained bishop of Cæsarea in 313. He had a considerable share in the contest relating to Arius; whose cause he, as well as several other bishops of Palestine, defended, being persuaded that Arius had been unjustly persecuted by Alexander bishop of Alexandria. He assisted at the council of Nice in 325; when he made a speech to the emperor Constantine on his coming to the council, and was placed next him on his right hand. He was present at the council of Antioch, in which Eustathius bishop of that city was deposed; but though he was chosen by the bishop and people of Antioch to succeed him, he absolutely refused it. In 335, he assisted at the council of Tyre held against Athanasius; and at the assembly of bishops at Jerusalem, at the time of the dedication of the church there. By these bishops he was sent to the emperor Constantine to defend what they had done against Athanasius; when he pronounced the panegyric made on that emperor during the public rejoicings in the beginning of the 30th year of his reign, which was the last of his life. Eusebius survived the emperor but a short time, for he died in 338. He wrote. 1. An Ecclesiastical History, of which Valetius has given a good edition in Greek and Latin; 2. The life of Constantine; 3. A treatise against Hierocles; 4. *Chronicon*; 5. *Preparationes Evangelicæ*; 6. *De demonstratione Evangelica*, of which there are but 10 books extant out of 20; and several other works, some of which are lost.

EUSTACHIUS, BARTHOLOMEW, physician and anatomist at Rome, flourished about the year 1550. His anatomical plates were discovered there in 1712, and published in 1714.

EUSTATHIANS, a name given to the Catholics of Antioch in the 4th century, on occasion of their refusal to acknowledge any other bishop beside St Eustathius, deposed by the Arians.

The denomination was given them during the episcopate of Paulinus, whom the Arians substituted to St Eustathius, about the year 330, when they began to hold their assemblies apart. About the year 350, Leontius of Phrygia, called the *eunuch*, who was an Arian, and was put in the see of Antioch, desired the Eustathians to perform their service in his church; which they accepting, the church of Antioch served indifferently both the Arians and Catholics.

This, we are told, gave occasion to two institutions, which have subsisted in the church ever since. The first was psalmody in two choirs; though M. Baillet thinks, that if they instituted an alternate psalmody between two choirs, it was between two Catholic choirs, and not by way of response to an Arian choir. The second was the doxology, *Glory be to the Father, and the Son, and the Holy Ghost*. See DOXOLOGY.

This conduct, which seemed to imply a kind of communion with the Arians, gave great offence to abun-

Euſtathians || Euſtatia.

dance of Catholics, who began to hold ſeparate meetings; and this formed the ſchiſm of Antioch. Upon this, the reſt, who continued to meet in the church, ceaſed to be called *Euſtathians*, and that appellation became reſtrained to the diſſenting party. St Flavianus, biſhop of Antioch in 381, and one of his ſucceſſors, Alexander, in 482, brought to paſs a coalition, or reunion, between the Euſtathians and the body of the church of Antioch, deſcribed with much ſolemnity by Theodoret, *Eccl.* lib. iii. c. 2.

EUSTATHIANS were alſo a ſect of heretics in the fourth century, denominated from their founder Euſtathius, a monk ſo fooliſhly fond of his own profeſſion, that he condemned all other conditions of life. Whether this Euſtathius was the ſame with the biſhop of Sebaſtia and chief of the Semi-Arians, is not eaſy to determine.

He excluded married people from ſalvation; prohibited his followers from praying in their houſes; and obliged them to quit all they had, as incompatible with the hopes of heaven. He drew them out of the other aſſemblies of Chriſtians to hold ſecret ones with him, and made them wear a particular habit: he appointed them to faſt on Sundays; and taught them, that the ordinary faſts of the church were needleſs, after they had attained to a certain degree of purity which he pretended to. He ſhowed great horror for chapels built in honour of martyrs, and the aſſemblies held therein. Several women ſeduced by his reaſons, forſook their huſbands, and abundance of ſlaves deſerted their maſters houſes. He was condemned at the council of Gangra in Paphlagonia, held between the years 326 and 341.

EUSTATHIUS, biſhop of Theſſalonica, in the 12th century, under the reigns of the emperors Emanuel, Alexander, and Andronicus Comnenus. He was a very eminent grammarian; and wrote commentaries upon Homer, and Dionyſius the geographer. The beſt edition of his Commentaries on Homer is that of Rome, printed in Greek, in 1542, in four volumes folio. His Commentaries on the Periegeſis of Dionyſius were printed by Mr Hudſon at Oxford, in 1697, 8vo. Euſtathius appears to have been alive in the year 1194.

EUSTATIA, St Eustatia, or *Euſtatius*, one of the Caribbee iſlands, belonging to the Dutch, and ſituated in W. Long. 62. 56. N. Lat. 17. 29. It is little elſe than a huge mountain, which formerly has, in all probability, been a volcano. Its ſituation is ſo ſtrong, that it has but one landing place; and that is fortified in ſuch a manner as to be almoſt impregnable. Tobacco is the chief product of the iſland; and it is cultivated to the very top of the pyramid, which terminates in a large plain ſurrounded with woods, but having a hollow in the middle, which ſerves as a large den for wild beaſts. No fewer than 5000 white people and 15,000 negroes ſubſiſt on this ſpot, where they rear hogs, kids, rabbits, and all kinds of poultry, in ſuch abundance, that they can ſupply their neighbours, after having ſerved themſelves.

The firſt Dutch colony ſent to this iſland conſiſted of about 1600 people. They were diſpoſſeſſed by the Engliſh from Jamaica in 1665. Soon after, the Dutch and French becoming confederates, the Engliſh were expelled in their turn. The French continuing to hold a garriſon in the iſland till the treaty of Breda, when it was reſtored to the Dutch. Soon after the revolution, the French drove out the Dutch, and were in their turn driven out by the Engliſh under Sir Timothy Thornhill, with the loſs of no more than eight men killed and wounded, though the fort they took mounted 16 guns, and was in every other reſpect very ſtrong. Sir Timothy found it neceſſary for the protection of the Dutch, to leave a ſmall Engliſh garriſon in the fort; but he granted the French no terms of capitulation, except for their lives and baggage. By the peace of Ryſwick, the entire property of this iſland was reſtored to the Dutch. Euſtatia.

This iſland was reduced by the Britiſh in the year 1781. Though not 20 miles in circumference, it abounded at that time with riches, by reaſon of the vaſt conflux of trade from every other iſland in theſe ſeas. Being a free port, it was open to all the ſubjects of the belligerent powers; and thus a communication was eſtabliſhed among them, through which they were enabled to carry on a commercial correſpondence, which greatly mitigated the inconveniences of war. The greateſt benefit, however, was reaped by the Dutch; who, by tranſacting all trading buſineſs for other nations, were thus intruſted with numberleſs commiſſions, and likewiſe enjoyed vaſt profits from the ſale of the merchandiſes to which they were entitled. At the time the attack was made upon them, they were ſo little under the apprehenſions of ſuch an event, that their warehouſes were not ſufficient to contain the quantity of commercial articles imported for ſale, and the beach and ſtreets were covered with hogſheads of tobacco and ſugar. In this ſituation, Admiral Rodney having received orders to commence hoſtilities againſt the Dutch, ſuddenly appeared before the iſland with ſuch an armament of ſea and land forces, as in its defenceleſs ſituation was not only uſeleſs but ridiculous. The governor could ſcarcely credit the officer who ſummoned him to ſurrender; but being convinced how matters ſtood, the only poſſible ſtep was taken, namely, to ſurrender the whole iſland and every thing in it, at diſcretion. Along with the iſland there fell into the hands of the captors a ſhip of 60 guns, with 250 ſail of merchantmen, while the value of property on the iſland was eſtimated at no leſs than four millions ſterling. This capture became afterwards a ſubject of diſcuſſion in parliament, where the conduct of the Britiſh commanders was ſeverely ſcrutinized by Mr Burke. The admiral and general made their defence in perſon: but the minority at that time were far from being ſatisfied; and it was ſuppoſed that on the change of miniſtry a rigid inquiry would have been ſet on foot, had not the ſplendour of Admiral Rodney's victory over de Graſſe put an end to all thoughts of that nature.

The iſland of St Euſtatius is naturally of ſuch difficult acceſs, as already obſerved, that it is almoſt impoſſible for an enemy to effect a landing if proper care is taken by thoſe who are in poſſeſſion of it. This very circumſtance proved the ruin of the new poſſeſſors. The Britiſh, ſecure in their inacceſſible ſituation, conducted themſelves in ſuch a manner as induced the Marquis de Bouille to make an attempt to regain it. Having ſailed from Martinico at the head of 2000 men, he arrived on the 26th of November 1781, off one of the landing

Euſtatia
||
Eutropius.

places of the iſland, which was deemed ſo inacceſſible that it had been left without a guard. With much loſs and difficulty, however, he landed here with four or five hundred of his people during the night. The appearance of day put an end to his landing any more; and he now ſaw himſelf obliged either to relinquiſh the enterpriſe or to attack the garriſon, which was almoſt double the number of thoſe he had on the iſland. He choſe the latter: and was favoured in his enterpriſe by the extreme negligence of his antagoniſts. A difficult paſs, which a few men might have occupied with ſucceſs againſt a great number, was left unguarded, which the marquis ſecured in time, and then puſhed forward with the utmoſt expedition. The Britiſh, miſtaking a body of Iriſh troops which attended the French commander for their own comrades, ſuffered them to approach without thinking of oppoſing them. They were then exerciſing on the parade; but were ſoon made ſenſible of their fatal miſtake by a cloſe diſcharge from their ſuppoſed friends, by which many were killed and wounded. The ſurpriſe occaſioned by this ſudden attack was ſo great, that no reſiſtance could be made; eſpecially as their commanding officer, Colonel Cockburn, who happened at that inſtant to come upon the parade, was made priſoner. A number of them, however, haſtened to the fort with a view of making head againſt the enemy; but the French had already taken poſſeſſion of the gate, and prevented the drawbridge from being raiſed. They entered the fort; which, being ſurrendered by thoſe who had taken ſhelter in it, the reſt of the garriſon, diſperſed in various places, and imagining the number of the enemy to be much greater than it really was, ſubmitted without any oppoſition. The French commander took this opportunity of ſhowing his diſintereſtedneſs in pecuniary matters. Among the ſpoils that fell into his hands a large ſum of money was claimed by the Britiſh commanding officer as being his private property, which was generouſly reſtored to him: in like manner the property of the Dutch inhabitants was reſerved to them, and nothing was allowed to be ſeized but the produce ariſing from the ſale of prizes that had been taken by the Engliſh when they captured the iſland.

EUSTYLE, in *Architecture*, a ſort of building in which the pillars are placed at the moſt convenient diſtance one from another, the intercolumniations being juſt two diameters and a quarter of the column, except thoſe in the middle of the face, before and behind, which are three diameters diſtant.

EUTERPE, one of the Muſes, daughter of Jupiter and Mnemoſyne. She preſided over muſic, and was looked upon as the inventreſs of the flute. She is repreſented as crowned with flowers and holding a flute in her hands: Some mythologiſts attributed to her the invention of tragedy, more commonly ſuppoſed to be the production of Melpomene.

EUTHYMIA, among the Greeks, ſignified ſuch a diſpoſition or ſtate of the mind, as could not be ruffled either by good or bad fortune, by ſickneſs or health, good or evil.

EUTROPIUS, Flavius, a Latin author, in the 4th century, was ſecretary to Conſtantine the Great, and afterwards bore arms under the emperor Julian, and followed that prince in his expedition againſt the Perſians. He wrote an Abridgement of the Roman Hiſtory, from the foundation of Rome to the reign of Valens; the beſt edition of which is that of Miſs Le Fevre, afterwards Madame Dacier, publiſhed at Paris for the uſe of the Dauphin, in 4to, in the year 1683.

Eutychians

EUTYCHIANS, ancient heretics, who denied the duplicity of natures in Chriſt; thus denominated from Eutyches, the archimandrite, or abbot of a monaſtery at Conſtantinople, who began to propagate his opinion A. D. 448. He did not, however, ſeem quite ſteady and conſiſtent in his ſentiments: for he appeared to allow of two natures, even before the union; which was apparently a conſequence he drew from the principles of the Platonic philoſophy, which ſuppoſes a pre-exiſtence of ſouls: accordingly, he believed that the ſoul of Jeſus Chriſt had been united to the divinity before the incarnation; but then he allowed no diſtinction of natures in Jeſus Chriſt ſince his incarnation. This hereſy was firſt condemned in a ſynod held at Conſtantinople by Flavian, in 448, approved by the council of Epheſus, called *conventus latronum*, in 449, and re-examined, and fulminated, in the general council of Chalceſion in 451. The legates of Pope Leo, who aſſiſted at it, maintained, that it was not enough to define, that there were two natures in Jeſus Chriſt; but inſiſted ſtrenuouſly, that, to remove all equivocations, they muſt add theſe terms, without being changed, or confounded, or divided.

The hereſy of the Eutychians, which made a very great progreſs throughout the eaſt, at length became divided into ſeveral branches. Nicephorus makes mention of no fewer than twelve: ſome called *Schematici*, or *Apparentes*, as only attributing to Jeſus Chriſt a phantom or appearance of fleſh, and no real fleſh: others, *Theodoſians*, from Theodoſius biſhop of Alexandria: others, *Jacobites*, from one James (*Jacobus*), of Syria; which branch eſtabliſhed itſelf principally in Armenia, where it ſtill ſubſiſts. Others were called *Acephali*, q. d. without head; and *Severians*, from a monk called *Severus*, who ſeized on the ſee of Antioch in 513. Theſe laſt were ſubdivided into five factions, viz. *Agnoetæ*, who attributed ſome ignorance to Jeſus Chriſt; the followers of Paul; Μιλαιται, that is, the black *Angelites*, thus called from the place where they were aſſembled; and laſtly, *Adrites* and *Cononites*.

Eutychians was alſo the name of another ſect, half Arian half Eunomian; which aroſe at Conſtantinople in the fourth century.

It being then a matter of mighty controverſy among the Eunomians at Conſtantinople, whether or not the Son of God knew the laſt day and hour of the world, particularly with regard to that paſſage in the goſpel of St Matthew, chap. xxiv. ver. 36. or rather that in St Mark, xiii. 32. where it is expreſſed, that the Son did not know it, but the Father only; Eutychius made no ſcruple to maintain, even in writing, that the Son did not know it; which ſentiment diſpleaſing the leaders of the Eunomian party, he ſeparated from them, and made a journey to Eunomius, who was then in exile. That heretic acquieſced fully in Eutychius's doctrine, and admitted him to his communion. Eunomius dying ſoon after, the chief of the Eunomians at Conſtantinople refuſed to admit Eutychius; who, upon this, formed a particular ſect of ſuch as adhered to him, called *Eutychians*.

This

Eutychius || Ex.

This ſame Eutychius, with one Theopronius, as was ſaid in Sozomen's time, were the occaſions of all the changes made by the Eunomians in the adminiſtration of baptiſm; which conſiſted, according to Nicephorus, in only uſing one immerſion, and not doing it in the name of the Trinity, but in memory of the death of Jeſus Chriſt. Nicephorus calls the chief of that ſect, not *Eutychius*, but *Eupſychius*, and his followers *Eunomiaupſychians*.

EUTYCHIUS, patriarch of Alexandria, lived about the ninth age; and wrote annals in the Arabic language, printed at Oxford in 1658, with a Latin verſion by Mr Pococke. Selden had printed ſomething of his before.

EUXINE or BLACK SEA, forms part of the boundary betwixt Europe and Aſia. It receives the Nieper, the Danube, and other large rivers; and extends from 28 to 40 degrees of E. Long. and from 40 to 46 of N. Lat. The ancients imagined this ſea to have been originally only a lake or ſtanding pool which broke firſt into the Propontis, and then into the Egean, waſhing away by degrees the earth which firſt kept it within bounds, and formed the two channels of the Boſphorus Thracius and Helleſpont, now the Dardanelles.—It was anciently called the *Axenus*, ſuppoſed to be from Aſhkenaz the ſon of Gomer, who is ſaid to have ſettled near it. This original being forgot in length of time, the Greeks explained it by *inhoſpitable*, which the word Axenos literally ſignifies; and therefore, when they came to conſider the inhabitants of theſe coaſts as more civilized and hoſpitable, they changed the name into Euxinus, which it ſtill retains.

EWE, the Engliſh name of a female ſheep. See OVIS, MAMMALIA *Index*.

EWERY, in the Britiſh cuſtoms, an office in the king's houſehold, to which belongs the care of the table-linen, of laying the cloth, and ſerving up water in ſilver ewers after dinner.

EX, a river that riſes in a barren tract of land, called Exmore, in Somerſetſhire; and after being joined by ſeveral little ſtreams, runs by Tiverton, where there is a ſtone bridge over the river. About nine miles below Tiverton, it is joined by a pretty large ſtream called the *Colombton*; and about two miles lower, by another ſtream formed by the junction of the Horton and Credy. With theſe additions, it waſhes the walls of Exeter. At Topſham, above four miles below Exeter, it receives another conſiderable addition to its ſtream; two miles farther, it is joined by the Ken; and falls into the ocean at Exmouth, after a courſe of about 40 miles. Ships of great burden go up to Topſham, from whence veſſels of 150 tons are conveyed to the quay at Exeter, by means of an artificial canal. The Ex is navigable for veſſels of conſiderable burden to Topſham. The paſſage, however, at the mouth of the river, is but narrow, having rocks on the eaſt ſide and broad ſands on the weſt; nor is the water on the bar more than ſix or ſeven feet deep at low water, but the tide riſes 14 or 15 feet, ſo that it is deep enough at high water. When ſhips are within the bar they may ride afloat at a place called Starcroſs, about a mile and a half from the river's mouth; but thoſe that go to Topſham lie aground on the ooze at low water.

EX OFFICIO, among lawyers, ſignifies the power a perſon has, by virtue of his office, to do certain acts without being applied to. Thus a juſtice of peace may, *ex officio*, at his diſcretion, take ſurety of the peace, without complaint made by any perſon whatſoever.

Exacerbation || Exaltation.

There was formerly an oath *ex officio*, whereby a ſuppoſed offender was compelled in the eccleſiaſtical court to confeſs, accuſe, or clear himſelf of a crime; but this law is repealed.

Ex Poſt Facto, in *Law*, ſomething done after another: thus an eſtate granted may be good by matter *ex poſt facto*, that was not ſo at firſt, as in caſe of election.

EXACERBATION. See PAROXYSM.

EXACTION, in *Law*, a wrong done by an officer, or a perſon in pretended authority, in taking a reward or fee that is not allowed by law.

A perſon guilty of exaction may be fined and impriſoned. It is often confounded with EXTORTION.

EXACUM, a genus of plants belonging to the tetrandria claſs; and in the natural method ranking under the 20th order, *Rotaceæ*. See BOTANY *Index*.

EXÆRESIS, in *Surgery*, the operation of extracting or taking away ſomething that is hurtful to the human body.

EXAGGERATION, in *Rhetoric*, a kind of hyperbole, whereby things are augmented or amplified by ſaying more than the truth, either as to good or bad.

EXAGGERATION, in *Painting*, a method by which the artiſt, in repreſenting things, changes them too much, or makes them too ſtrong, either in reſpect of the deſign or colouring. It differs from *caricaturing*, in that the latter perverts or gives a turn to the features of a face, &c. which they had not, whereas exaggeration only heightens or improves what they had.

EXALTATION, or ELEVATION, is chiefly uſed in a figurative ſenſe, for the raiſing or advancing a perſon to ſome eccleſiaſtical dignity; and particularly to the papacy.

EXALTATION of the Croſs is a feaſt of the Romiſh church, held on the 14th of September; in memory, as is generally ſuppoſed, of this, that the emperor Heraclius brought back the true croſs of Jeſus Chriſt on his ſhoulders, to the place on Mount Calvary from which it had been carried away 14 years before by Coſroes king of Perſia, at his taking of Jeruſalem, under the reign of the emperor Phocas. The croſs was delivered up by a treaty of peace made with Siroe, Coſroes's ſon. The inſtitution of this treaty is commonly ſaid to have been ſignalized by a miracle; in that Heraclius could not ſtir out of Jeruſalem with the croſs while he had the imperial veſtments on enriched with gold and precious ſtones, but bore it with eaſe in a common dreſs.

But long before the reign of Heraclius there had been a feaſt of the ſame denomination obſerved both in the Greek and Latin churches, on occaſion of what our Saviour ſaid in St John xii. 32. *And I, if I be exalted, or lifted up, will draw all men unto me.* And again, in chap. viii. ver. 28. *When you have exalted, or lifted up the Son of Man, then ſhall ye know that I am he.*

The feaſt of the dedication of the temple built by Conſtantine was held, ſays Nicephorus, on the 14th of

Exaltation || Example.

September, the day on which the temple had been conſecrated, in the year 335; and this feaſt was alſo called the *exaltation of the croſs*, becauſe it was a ceremony therein, for the biſhop of Jeruſalem to aſcend a high place, built by Conſtantine for that purpoſe, in manner of a pulpit, called by the Greeks the *ſacred myſteries of God*, or *the holineſs of God*, and there hoiſt up the croſs for all the people to ſee it.

EXALTATION, in *Phyſics*, denotes the act, or operation, of elevating, purifying, ſubtilizing, or perfecting any natural body, its principles and parts; alſo the quality or diſpoſition which bodies acquire by ſuch operation. The term *exaltation* has been peculiarly affected by the chemiſts and alchemiſts; who imagining it to have ſome extraordinary emphaſis, are employing it on every occaſion.

EXALTATION, in *Aſtrology*, is a dignity which a planet acquires in certain ſigns or parts of the zodiac; which dignity is ſuppoſed to give it an extraordinary virtue, efficacy, and influence. The oppoſite ſign, or part of the zodiac, is called the dejection of the planet. Thus the 15th degree of Cancer is the exaltation of Jupiter, according to Albumazor, becauſe it was the aſcendant of that planet at the time of the creation; that of the ſun is in the 19th degree of Aries, and its dejection in Libra; that of the moon is in Taurus, &c. Ptolemy gives the reaſon of this in his firſt book De Quadrup.

EXAMINATION, an exact and careful ſearch or inquiry, in order to diſcover the truth or falſehood of a thing.

Self-Examination, is a point much inſiſted on by divines, and particularly the ancient fathers, by way of preparation to repentance. St Ignatius reduces it to five points; viz. 1. A returning thanks to God for his benefits. 2. A begging of grace and light, to know and diſtinguiſh our ſins. 3. A running over all our actions, occupations, thoughts and words, in order to learn what has been offenſive to God. 4. A begging of pardon, and conceiving a ſincere ſorrow for having diſpleaſed him. And, 5. Making a firm reſolution not to offend him any more; and taking the neceſſary precautions to preſerve ourſelves from it.

EXAMINERS, in chancery, two officers of that court, who examine, upon oath, witneſſes produced in cauſes depending there, by either the complainant or defendant, where the witneſſes live in London or near it. Sometimes parties themſelves, by particular order, are examined. In the country, above 20 miles from London, on the parties joining in commiſſion, witneſſes are examined by commiſſioners, being uſually counſellors or attorneys not concerned in the cauſe.

EXAMPLE, in a general ſenſe, denotes a copy or pattern.

EXAMPLE, in a moral ſenſe, is either taken for a type, inſtance, or precedent, for our admonition, that we may be cautioned againſt the faults or crimes which others have committed, by the bad conſequences which have enſued from them; or example is taken for a pattern for our imitation, or a model for us to copy after.

That examples have a peculiar power above the naked precept, to diſpoſe us to the practice of virtue and holineſs, may appear by conſidering, 1. That they moſt clearly expreſs to us the nature of our duties in their ſubjects and ſenſible effects. General precepts form abſtract ideas of virtue; but in examples, virtues are moſt viſible in all their circumſtances. 2. Precepts inſtruct us in what things are our duty; but examples aſſure us that they are poſſible. When we ſee men like ourſelves, who are united to frail fleſh, and in the ſame condition with us, to command their paſſions, to overcome the moſt glorious and glittering temptations, we are encouraged in our ſpiritual warfare. 3. Examples, by ſecret and lively incentive, urge us to imitation. We are touched in another manner by the viſible practice of good men, which reproaches our defects, and obliges us to the ſame zeal which laws, though wiſe and good, will not effect.

Example || Exarch.

The example of our Saviour is moſt proper to form us to holineſs; it being abſolutely perfect, and accommodated to our preſent ſtate. There is no example of a mere man that is to be followed without limitation: But the example of Chriſt is abſolutely perfect; his converſation was a living law: "He was holy, harmleſs, undefiled, and ſeparate from ſinners."

EXAMPLE, in *Rhetoric*, denotes an imperfect kind of induction or argumentation; whereby it is proved, that a thing which happened on ſome other occaſion will happen again on the preſent one, from the ſimilitude of the caſes. As, "The war of the Thebans, againſt their neighbours the Phocians, was ruinous; conſequently, that of the Athenians againſt their neighbours, will likewiſe be fatal."

EXANTHEMA, among *Phyſicians*, denotes any kind of efflorescence or eruption, as the meaſles, purple ſpots in the plague, or malignant fevers, &c.

EXARCH, in antiquity, an appellation given, by the emperors of the eaſt, to certain officers ſent into Italy, in quality of vicars, or rather prefects, to defend that part of Italy which was yet under their obedience, particularly the city of Ravenna, againſt the Lombards, who had made themſelves maſters of the greateſt part of the reſt.

The reſidence of the exarch was at Ravenna; which city, with that of Rome, was all that was left the emperors. The firſt exarch was the patrician Boetius, famous for his treatiſe, De Conſolatione Philoſophiæ; appointed in 568 by the younger Juſtin. The exarchs ſubſiſted about 185 years, and ended in Eutychius: under whoſe exarchate the city of Ravenna was taken by the Lombard king Aſtulphus, or Aſtolphus.

The emperor Frederic created Heraclius, archbiſhop of Lyons, a deſcendant of the illuſtrious houſe of Montboiſſier, exarch of the whole kingdom of Burgundy; a dignity till that time unknown anywhere but in Italy, particularly in the city of Ravenna.

Homer, Philo, and other ancient authors, give likewiſe the name *exarchus* to the choragus or maſter of the ſingers, in the ancient choruſes, or him who ſung firſt: the word αρχω or αρχομαι, ſignifying equally to *begin*, and to *commend*.

Exarch of a Dioceſe was, anciently, the ſame with primate. This dignity was inferior to the patriarchal, yet greater than the metropolitan.

EXARCH alſo denotes an officer, ſtill ſubſiſting in the Greek church; being a kind of deputy or legate *à latere* of the patriarch, whoſe office it is to viſit the provinces allotted him, in order to inform himſelf of the

Exarch || Exception.

the lives and manners of the clergy; take cognizance of eccleſiaſtical cauſes; the manner of celebrating divine ſervice; the adminiſtration of the ſacraments, particularly confeſſion; the obſervance of the canons; monaſtic diſcipline; affairs of marriages, divorces, &c. but above all, to take an account of the ſeveral revenues which the patriarch receives from ſeveral churches; and, particularly, as to what regards the collecting the ſame.

The exarch, after having greatly enriched himſelf in his poſt, frequently riſes to the patriarchate itſelf.

EXARCH is alſo uſed, in the eaſtern church antiquity, for a general or ſuperior over ſeveral monaſteries; the ſame that we otherwiſe call archimandrite; being exempted, by the patriarch of Conſtantinople, from the juriſdiction of the biſhops; as are now the generals of the Romiſh monaſtic orders.

EXAUCTORATIO, in the Roman military diſcipline, differed from the miſſio, which was a full diſcharge, and took place after they had ſerved in the army 20 years; whereas the exauctoratio was only a partial diſcharge: they loſt their pay indeed, but ſtill kept under their colours or *vexilla*, though not under the *aquila* (or eagle), which was the ſtandard of the legion: whence, inſtead of *Legionarii*, they were called *Subſignani*, and were retained till they had either ſerved their full time or had lands aſſigned them. The exauctoratio took place after they had ſerved 17 years.

EXCALCEATION, among the Hebrews, was a particular law, whereby a widow, whom her huſband's brother refuſed to marry, had a right to ſummon him to a court of juſtice; and, upon his refuſal, might excalceate him, that is, pull off one of his ſhoes, and ſpit in his face; both of them actions of great ignominy.

EXCELLENCY, a title anciently given to kings and emperors, but now to ambaſſadors, generals, and other perſons who are not qualified for that of *highneſs*, and yet are to be elevated above the other inferior dignities.

EXCENTRIC, in *Geometry*, a term applied to circles and ſpheres which have not the ſame centre, and conſequently are not parallel; in oppoſition to concentric, where they are parallel, having one common centre.

EXCENTRICITY, in *Aſtronomy*, is the diſtance of the centre of the orbit of a planet from the centre of the ſun; that is, the diſtance between the centre of the ellipſis and the focus thereof.

EXCEPTION, ſomething reſerved, or ſet aſide, and not included in a rule.

It is become proverbial, that there is no rule without an exception; intimating, that it is impoſſible to comprehend all the particular caſes, under one and the ſame maxim. But it is dangerous following the exception preferably to the rule.

EXCEPTION, in *Law*, denotes a ſtop or ſtay to an action; and is either dilatory or peremptory, in proceedings at common law; but in chancery it is what the plaintiff alleges againſt the ſufficiency of an anſwer, &c.

An exception is no more than the denial of what is taken to be good by the other party, either in point of law or pleading. The counſel in a cauſe are to take all their exceptions to the record at one time, and before the court has delivered any opinion of it.

Excerpt || Exchange.

EXCERPT, in matters of literature. See EXTRACT.

EXCESS, in *Arithmetic* and *Geometry*, is the difference between any two unequal numbers or quantities, or that which is left after the leſſer is taken from or out of the greater.

EXCHANGE, in a general ſenſe, a contract or agreement, whereby one thing is given or exchanged for another.

EXCHANGE, in commerce, is the receiving or paying of money in one country for the like ſum in another, by means of bills of exchange.

The ſecurity which merchants commonly take from one another when they circulate their buſineſs, is a bill of exchange, or a note of hand: theſe are looked upon as payment. See BILL, and *Mercantile* LAWS.

The punctuality of acquitting theſe obligations is eſſential to commerce; and no ſooner is a merchant's accepted bill proteſted, than he is conſidered as a bankrupt. For this reaſon, the laws of moſt nations have given very extraordinary privileges to bills of exchange. The ſecurity of trade is eſſential to every ſociety; and were the claims of merchants to linger under the formalities of courts of law when liquidated by bills of exchange, faith, confidence, and punctuality, would quickly diſappear, and the great engine of commerce would be totally deſtroyed.

A regular bill of exchange is a mercantile contract, in which four perſons are concerned, viz. 1. The drawer, who receives the value: 2. His debtor, in a diſtant place, upon whom the bill is drawn, and who muſt accept and pay it: 3. The perſon who gives value for the bill, to whoſe order it is to be paid: and, 4. The perſon to whom it is ordered to be paid, creditor to the third.

By this operation, reciprocal debts, due in two diſtant parts, are paid by a ſort of transfer, or permutation of debtors and creditors.

(A) in London is creditor to (B) in Paris, value 100l. (C) again in London is debtor to (D) in Paris for a like ſum. By the operation of the bill of exchange, the London creditor is paid by the London debtor; and the Paris creditor is paid by the Paris debtor; conſequently the two debts are paid, and no money is ſent from London to Paris nor from Paris to London.

In this example, (A) is the drawer, (B) is the accepter, (C) is the purchaſer of the bill, and (D) receives the money. Two perſons here receive the money, (A) and (D); and two pay the money, (B) and (C); which is juſt what muſt be done when two debtors and two creditors clear accounts.

This is the plain principle of a bill of exchange. From which it appears, that reciprocal and equal debts only can be acquitted by them.

When it therefore happens, that the reciprocal debts of London and Paris (to uſe the ſame example) are not equal, there ariſes a balance on one ſide. Suppoſe London to owe Paris a balance, value 100l. How can this be paid? Anſwer, it may either be done with or without the intervention of a bill.

With a bill, if an exchanger, finding a demand for a bill upon Paris for the value of 100l. when Paris

owes

Exchange. owes no more to London ſends 100l. to his correſpondent at Paris in coin, at the expence (ſuppoſe) of 1l. and then, having become creditor on Paris, he can give a bill for the value of 100l. upon his being repaid his expence, and paid for his riſk and trouble.

Or it may be paid without a bill, if the London debtor ſends the coin himſelf to his Paris creditor, without employing an exchanger.

This laſt example ſhows of what little uſe bills are in the payment of balances. As far as the debts are equal, nothing can be more uſeful than bills of exchange; but the more they are uſeful in this eaſy way of buſineſs, the leſs profit there is to any perſon to make a trade of exchange, when he is not himſelf concerned either as debtor or creditor.

When merchants have occaſion to draw and remit bills for the liquidation of their own debts, active and paſſive, in diſtant parts, they meet upon 'Change; where, to purſue the former examples, the creditors upon Paris, when they want money for bills, look out for thoſe who are debtors to it. The debtors to Paris again, when they want bills for money, ſeek for thoſe who are creditors upon it.

This market is conſtantly attended by brokers, who relieve the merchant of the trouble of ſearching for thoſe he wants. To the broker every one communicates his wants, ſo far as he finds it prudent; and by going about among all the merchants, the broker diſcovers the ſide upon which the greater demand lies, for money or for bills.

He who is the demander in any bargain, has conſtantly the diſadvantage in dealing with him of whom he demands. This is nowhere ſo much the caſe as in exchange, and renders ſecrecy very eſſential to individuals among the merchants. If the London merchants want to pay their debts to Paris, when there is a balance againſt London, it is their intereſt to conceal their debts, and eſpecially the neceſſity they may be under to pay them; from the fear that thoſe who are creditors upon Paris would demand too high a price for the exchange over and above par.

On the other hand, thoſe who are creditors upon Paris, when Paris owes a balance to London, are as careful in concealing what is owing to them by Paris, from the fear that thoſe who are debtors to Paris would avail themſelves of the competition among the Paris creditors, in order to obtain bills for their money, below the value of them, when at par. A creditor upon Paris, who is greatly preſſed for money at London, will willingly abate ſomething of his debt, in order to get one who will give him money for it.

From the operation carried on among merchants upon 'Change, we may diſcover the conſequence of their ſeparate and jarring intereſts. They are conſtantly intereſted in the ſtate of the balance. Thoſe who are creditors on Paris, fear the balance due to London; thoſe who are debtors to Paris, dread a balance due to Paris. The intereſt of the firſt is to diſſemble what they fear; that of the laſt, to exaggerate what they wiſh. The brokers are thoſe who determine the courſe of the day; and the moſt intelligent merchants are thoſe who deſpatch their buſineſs before the fact is known.

Now, how is trade in general intereſted in the queſtion, Who ſhall outwit, and who ſhall be outwitted, Exchange. in this complicated operation of exchange among merchants?

The intereſt of trade and of the nation is principally concerned in the proper method of paying and receiving the balances. It is alſo concerned in preſerving a juſt equality of profit and loſs among all the merchants, relative to the real ſtate of the balance. Unequal competition among men engaged in the ſame purſuit, conſtantly draws along with it bad conſequences to the general undertaking; and ſecrecy in trade will be found, upon examination, to be much more uſeful to merchants in their private capacity, than to the trade they are carrying on.

Merchants endeavour to ſimplify their buſineſs as much as poſſible; and commit to brokers many operations which require no peculiar talents to execute. This of exchange is of ſuch a nature, that it is hardly poſſible for a merchant to carry on the buſineſs of his bills, without their aſſiſtance, upon many occaſions. When merchants come upon 'Change, they are ſo full of fear and jealouſies, that they will not open themſelves to one another, leſt they ſhould diſcover what they want to conceal. The broker is a confidential man, in ſome degree, between parties, and brings them together.

Beſides the merchants who circulate among themſelves their reciprocal debts and credits ariſing from their importation and exportation of goods, there is another ſet of merchants who deal in exchange; which is the importation and exportation of money and bills.

Were there never any balance on the trade of nations, exchangers and brokers would find little employment: reciprocal and equal debts would eaſily be tranſacted openly between the parties themſelves. No man feigns and diſſembles, except when he thinks he has an intereſt in ſo doing.

But when balances come to be paid, exchange becomes intricate; and merchants are ſo much employed in particular branches of buſineſs, that they are obliged to leave the liquidation of their debts to a particular ſet of men, who make it turn out to the beſt advantage to themſelves.

Whenever a balance is to be paid, that payment coſts, as we have ſeen, an additional expence to thoſe of the place who owe it, over and above the value of the debt.

If, therefore, this expence be a loſs to the trading man, he muſt either be repaid this loſs by thoſe whom he ſerves, that is, by the nation; or the trade he carries on will become leſs profitable.

Every one will agree, that the expence of high exchange upon paying a balance is a loſs to a people, no way to be compenſated by the advantages they reap from enriching the few individuals among them who gain by contriving methods to pay it off; and if an argument is neceſſary to prove this propoſition, it may be drawn from this principle, viz. whatever renders the profit upon trade precarious or uncertain, is a loſs to trade in general; this loſs is the conſequence of high exchange; and although a profit does reſult from it upon one branch of trade, the exchange buſineſs, yet that cannot compenſate the loſs upon every other.

We

Exchange. We may, therefore, here repeat what we have ſaid above, that the more difficulty is found in paying a balance, the greater is the loſs to a nation. Exchange.

The Courſe of Exchange.

The courſe of exchange is the current price betwixt two places, which is always fluctuating and unſettled, being ſometimes above and ſometimes below par, according to the circumſtances of trade.

When the courſe of exchange riſes above par, the country where it riſes may conclude for certain, that the balance of trade runs againſt them. The truth of this will appear, if we ſuppoſe Britain to import from any foreign place goods to the value of 100,000l. at par, and export only to the value of 80,000l. In this caſe, bills on the ſaid foreign place will be ſcarce in Britain, and conſequently will riſe in value; and after the 80,000l. is paid, bills muſt be procured from other places at a high rate to pay the remainder, ſo that perhaps 120,000l. may be paid for bills to diſcharge a debt of 100,000l.

Though the courſe of exchange be in a perpetual flux, and riſes or falls according to the circumſtances of trade; yet the exchanges of London, Holland, Hamburgh, and Venice, in a great meaſure regulate thoſe of all other places in Europe.

I. *Exchange with Holland.*

MONEY TABLE.

		Par in Sterling.		*s.*	*d.*
8 Pennings, or 2 duytes,	make	1 groat or penny	=	0	0.54
2 Groats, or 16 pennings,		1 ſtiver	=	0	1.09
6 Stivers, or 12 pence,		1 ſchilling	=	0	6.56
20 Schillings,		1 pound Flemiſh	=	10	11.18
20 Stivers, or 40 pence,		1 gilder or florin	=	1	9.86
6 Guilders, or florins,		1 pound Flemiſh	=	10	11.18
2½ Guilders, or florins,		1 rixdollar	=	4	6.66

In Holland there are two ſorts of money, bank and current. The bank is reckoned good ſecurity; demands on the bank are readily anſwered; and hence bank money is generally rated from 3 to 6 *per cent.* better than the current. The difference between the bank and current money is called the *agio*.

Bills on Holland are always drawn in bank money; and if accounts be ſent over from Holland to Britain in current money, the Britiſh merchant pays theſe accounts by bills, and in this caſe has the benefit of the agio.

PROB. I. *To reduce bank money to current money.*

RULE. As 100 to 100+agio, ſo the given guilders to the anſwer.

EXAMP. What will 2210 guilders in bank money amount to in Holland currency, the agio being 3⅛ *per cent.*?

Guild.

As 100 : 103⅛ :: 2210
8 8 825

800 825 11050
4420
17680

Guild. ſt. pen.
8|00)18232|50(2279 1 4 cur.
16...20

22 10|00(
16 8

63 2
56 16

72 32
72 32

Or, by practice.

50)2210
44.2 = 2 *per cent.*
22.1 = 1 *per cent.*
2.7625. = ⅛ *per cent.*

2279.0625

If the agio only be required, make the agio the middle term, thus:

Guil. ſt. pen.

As 100 : 3⅛ :: 2210 : 69 1 4 agio. Or work by practice as above.

PROB. II. *To reduce current money to bank money.*

RULE. As 100+agio to 100, ſo the given guilders to the anſwer.

EXAMPLE. What will 2279 guilders 1 ſtiver 4 pennings, Holland currency, amount to in bank money, the agio being 3⅛ *per cent.*?

Guild. *Guild.* *Guild.* *ſt. pen.*
As 103⅛ : 100 :: 2279 1 4
8 8 20

825 800 45581
20 16

16500 273490
16 45581

990 729300
165 800

8)264|000 8)583440|000
3)33 3)72930 *Guild.*
11 11)24310(2210 bank.

An

Exchange. An Amſterdam, Rotterdam, Middleburgh, &c. books and accounts are kept by ſome in guilders, ſtivers, and pennings, and by others in pounds, ſhillings, and pence Flemiſh.

Britain gives 1l. ſterling for an uncertain number of ſhillings and pence Flemiſh. The par 1l. ſterling for 36.59s. Flemiſh; that is, 1l. 16s. 7.08d. Flemiſh.

When the Flemiſh rate riſes above par, Britain gains and Holland loſes by the exchange, and *vice verſa*.

Sterling money is changed into Flemiſh, by ſaying,

As 1l. ſterling to the given rate,

So is the given ſterling to the Flemiſh ſought.

Or, the Flemiſh money may be caſt up by practice.

Dutch money, whether pounds, ſhillings, pence Flemiſh, or guilders, ſtivers, pennings, may be changed into ſterling, by ſaying.

As the given rate to 1l. ſterling.

So the given Dutch to the ſterling ſought.

EXAMPLE I. A merchant in Britain draws on Amſterdam for 782l. ſterling: How many pounds Flemiſh, and how many guilders, will that amount to, exchange at 34s. 8d. per pound ſterling?

Decimally.

L.	*s.*	*d.*	*L.*
If 1	: 34	8	:: 782
	12		
	416		
	782		
	832		
	3328		
	2912		
12)325312			
	d.		
2|0)2710|9	4		
L. 1355	9	4	*Flem.*

L.	*s.*	*L.*
If 1	: 34.6	:: 782
	782	
	693	
	27733	
	24266	
2|0)2710|9.3		
L. 1355	9	4 *Flem.*

By practice.

	L.	*s.*	*d.*
	782		
10s. = ½	391		
4s. = ⅓	156	8	
8d. = ⅙	26	1	4
	1355	9	4 *Fl.*

Or thus:

	L.	*s.*	*d.*
	782		
14s. = 7/10	547	8	
8d. = 1/10	26	1	4
	1355	9	4 *Fl.*

Multiply the Flemiſh pounds and ſhillings by 6, and the product will be guilders and ſtivers; and if there be any pence, multiply them by 8 for pennings: or, divide the Flemiſh pence by 40, and the quot will be guilders, and the half of the remainder, if there be any, will be ſtivers, and one penny odd will be half a ſtiver, or 8 pennings, as follows:

£.	*s.*	*d.*
1355	9	4
	6	

Guild. 8131 16 *ſtiv.*

Flem. pence.

4\|0)32531\|2(32 *rem.*

Guild. 8132 16 *ſtiv.*

2. Change 591l. 5s. Flemiſh into ſterling money, exchange at 37s. 6d. Flemiſh *per* l. Sterling.

Flem.	*s.*	*d.*	*Ster.*	*L.*	*Flem.*	*L.*	*s.*
If 37	6	:	1	::	591	5	
	2					20	
5)75					11825		
4)15					2		
3					5)23653		
					5) 4730		
					3) 946		
					315½		

L. *s.* *d.*

Anſ. 315 5 8 *Ster.*

Decimally.

5) *L.*	*L.*	5) *L.*
If 1.875	: 1 ::	591.25
5) .375		5)118.25
5) .075		5) 23.65
.015	.015)	4.73(313.3
		45
		23
		15
		80
		75
		50
		45
		*5

Holland exchanges with other nations as follows, viz. with.

	Flem. d.
Hamburgh, on the dollar,	= 66⅔
France, on the crown,	= 54
Spain, on the ducat,	= 109⅘
Portugal, on the cruſade,	= 50
Venice, on the ducat,	= 93
Genoa, on the pezzo,	= 100
Leghorn, on the piaſtre,	= 100
Florence, on the crown,	= 120
Naples, on the ducat,	= 74⅔
Rome, on the crown,	= 136
Milan, on the ducat,	= 102
Bologna, on the dollar,	= 94⅘

Exchange between Britain and Antwerp, as alſo the Auſtrian Netherlands, is negotiated the ſame way as with Holland; only the par is ſomewhat different, as will be deſcribed in article 2d, following.

II. *Exchange with Hamburgh.*

MONEY TABLE.

			Par in Sterling.	*s.*	*d.*
12 Phenning	make	1 ſchilling-lub	=	0	1⅛
16 Schilling-lubs	make	1 mark	=	1	6
2 Marks	make	1 dollar	=	3	0
3 Marks	make	1 rixdollar	=	4	6
6¼ Marks	make	1 ducat	=	9	4½

Books

Exchange. Books and accounts are kept at the bank, and by moſt people in the city, in marks, ſchilling-lubs, and phennings; but ſome keep them in pounds, ſchillings, and groots Flemiſh.

The agio at Hamburgh runs between 20 and 40 *per cent.* All bills are paid in bank money.

Hamburgh exchanges with Britain by giving an uncertain number of ſchillings and groots Flemiſh for the pound ſterling. The groot or penny Flemiſh here, as alſo at Antwerp, is worth $\frac{5}{9}\frac{4}{0}$ of a penny ſterling; and ſo ſomething better than in Holland, where it is only $\frac{5}{1}\frac{4}{0}\frac{0}{0}$d. ſterling.

		Flemiſh.
6 Phennings		1 groot or penny
6 Schilling-lubs		1 ſchilling
1 Schilling-lub	makes	2 pence or groots
1 Mark		32 pence or groots
$7\frac{1}{2}$ Marks		1 pound.

The par with Hamburgh, and alſo with Antwerp, is 35s. $6\frac{3}{4}$d. Flemiſh for 1l. ſterling.

EXAMPLES. 1. How many marks muſt be received at Hamburgh for 300l. ſterling, exchange at 35s. 3d. Flemiſh *per* l. ſterling?

L. s. d. L.

If 1 : 35 3 :: 300

12

423

300

M. ſch.

32)126900(3965 10

96···

309

288

210

192

180

160

(20)

16

)320

32

(0)

Decimally.

Flem. s. Marks. Flem. s.

If 20 : 7.5 :: 35.25

4 : 1.5 :: 35.25

1.5

17625

3525

4)52.875

Marks in 1l. ſterling 13.21875

300

Marks in 300l. ſterling 3965.62500

16

3750

625

Schilling-lubs 10.000

2. How much ſterling money will a bill of 3965 marks 10 ſchilling-lubs amount to, exchange at 35s. 3d. Flemiſh per pound ſterling? Exchange.

Fl.s. d. L.St. Mks. ſch.

If 35 3 : 1 :: 3965 10

12 32 2

423 7930 20d.

11897

423)126900(300l. ſter.

1269

Decimally.

4 : 1.5 :: 35.25

1.5

17625

2225

4)52.875(13.21875

13.21875)3965.62500(300l. ſter.

3965625

III. *Exchange with France.*

MONEY TABLE.

			Par in Ster.	s.	d.
12 Deniers		1 ſol	=	0	$0\frac{12}{40}$
20 Sols	make	1 livre	=	0	$9\frac{3}{4}$
3 Livres		1 crown	=	2	$5\frac{1}{4}$

At Paris, Rouen, Lyons, &c. books and accounts are kept in livres, ſols, and deniers; and the exchange with Britain is on the crown, or ecu, of 3 livres, or 60 ſols Tournois. Britain gives for the crown an uncertain number of pence, commonly between 30 and 34, the par, as mentioned above, being $29\frac{1}{2}$d.

EXAMPLE 1. What ſterling money muſt be paid in London to receive in Paris 1978 crowns 25 ſols, exchange at $31\frac{5}{8}$d. per crown?

Sols. d. Cr. ſols.

If 60 : $31\frac{5}{8}$ :: 1978 25

60

253

118705

253

356115

593525

237410

6|0)300323|6|5 *Rem.*

8)500539 3

12)62567 11

2|0)5213 13

L. 260 13 $11\frac{1}{8}$ *Anſ.*

Exchange.

By Practice.

d.		Cr.	Sols.	
		1978	25, at $31\frac{5}{8}$d.	
30 =	$\frac{1}{8}$	247	5	0
$1\frac{1}{2}$ =	$\frac{1}{20}$	12	7	3
$\frac{1}{8}$ =	$\frac{1}{12}$	1	0	$7\frac{1}{4}$
Sols. 20 =	$\frac{1}{3}$	0	0	$10\frac{1}{2}$
5 =	$\frac{1}{4}$	0	0	$2\frac{1}{4}$
		260	13	$11\frac{1}{4}$

If you work decimally, fay,

Cr.	d. Ster.	Cr	d. Ster.
As 1 :	31.625 ::	1978.41β :	62567.427083

2. How many French livres will L.121 : 18 : 6 fterling amount to, exchange at $32\frac{7}{8}$d. per crown ?

d.	Liv.	L.	s.	d.
If $32\frac{7}{8}$:	3 ::	121	18	6
	8	20		
865	—	—		
	24	2438		
		12		
		29262		
		24		
		117048		
		58524		

Liv. fols. den.

263)702288(2670 5 11 *Anf.*

Rem. (78=5 fols 11 deniers.

IV. *Exchange with Portugal.*

Money Table.

		Par in Ster.	s.	d.	f.
		1 ree =	0	0	0.27
400 rees	make	1 cruſade =	2	3	
1000 rees	make	1 millree =	5	$7\frac{1}{2}$	

In Liſbon, Oporto, &c. books and accounts are generally kept in rees and millrees; and the millrees are diſtinguiſhed from the rees by a mark ſet between them thus, 485 ⚜ 372; that is, 485 millrees and 372 rees.

Britain, as well as other nations, exchanges with Portugal on the millree; the par, as in the table, being $67\frac{1}{4}$d. fterling. The courſe with Britain runs from 67d. to 68d. fterling per millree.

Example 1. How much fterling money will pay a bill of 827 ⚜ 160 rees, exchange at $63\frac{3}{8}$d. fterling per millree ?

Rees.	d.	Rees.	
If 1000 :	$63\frac{3}{8}$ ::	827.160	
8		507	
8000	507	579012	
		413580	
			Rem.
8000)419370.120			2
12)52421	—		5d.
20) 4368	—		8s.
L. 218	8	$5\frac{1}{4}$	*Anf.*

Exchange.

By Practice.

d.		Rees.	
		827.160, at $63\frac{3}{8}$d.	
60 =	$\frac{1}{4}$	206.790	
3 =	$\frac{1}{20}$	10.3395	
$\frac{2}{8}$ =	$\frac{1}{120}$	.861625	
=	$\frac{1}{2}$	.4308125	
		218.4219375	

The rees being thouſandth-parts of the millrees, are annexed to the integer, and the operation proceeds exactly as in decimals.

2. How many rees of Portugal will 500l. fterling amount to, exchange at 5s. $4\frac{5}{8}$d. per millree ?

d.	Rees.	L.
If $64\frac{5}{8}$:	1000 ::	500
	8	20
517	—	—
	8000	10000
		12
		120000
		8000

Rees.

517)960000000(1856.866 *Anf.*

V. *Exchange with Spain.*

Money Table.

		Par in Ster.	s.	d.
35 mervadies	make	1 rial =	0	$5\frac{3}{8}$
8 rials	make	1 piaſtre =	3	7
375 mervadies	make	1 ducat =	4	$11\frac{1}{4}$

In Madrid, Bilboa, Cadiz, Malaga, Seville, and moſt of the principal places, books and accounts are kept in piaſtres, called alſo *dollars*, rials, and mervadies; and they exchange with Britain generally on the piaſtre, and ſometimes on the ducat. The courſe runs from 35d. to 45d. fterling for a piaſtre or dollar of 8 rials.

Examp. 1. London imports from Cadiz goods to the value of 2163 piaſtres and 4 rials: How much fterling will this amount to, exchange at $38\frac{1}{8}$ fterling per piaſtre ?

d.		Piaſt.	Rials.	
		2163	4 at $38\frac{1}{8}$d.	
24 =	$\frac{1}{10}$	216	6	
12 =	$\frac{1}{2}$	108	3	
2 =	$\frac{1}{6}$	18	0	6
$\frac{2}{8}$ =	$\frac{1}{8}$	2	5	$0\frac{3}{4}$
$\frac{1}{8}$ =	$\frac{1}{16}$	1	2	$6\frac{3}{8}$
		345	17	$1\frac{7}{8}$
			1	$7\frac{3}{10}$

Rials.	d.
4 =	$38\frac{3}{8}$ each.
	$19\frac{3}{10}$

L. 345 18 $8\frac{5}{10}$ *Anf.*

2. London remits to Cadiz 345l. 18s. $8\frac{5}{10}$. How much Spaniſh money will this amount to, exchange at $38\frac{1}{8}$d. fterling per piaſtre ?

Exchange.

If $38\frac{1}{8}$: 1 :: 345 18 $8\frac{5}{16}$

	20	
307		614)1328389(2163 piaſtres.
2	6918	1228···
	12	
614		1003
	83024	614
	16	
		3898
	498149	3684
	83024	
		2149
Carried up	1328389	1842
		307
		8
	Piaſt. Rials.	614)2456(4 rials.
Anſ.	2163 4	2456

VI. *Exchange with Venice.*

Money Table.

$5\frac{1}{3}$ Soldi, 24 Gros } make { 1 gros; 1 ducat = $50\frac{1}{2}$d. ſterling.

The money of Venice is of three ſorts, viz. two of bank money, and the picoli money. One of the banks deals in banco money, and the other in banco current. The bank money is 20 per cent. better than the banco current, and the banco current 20 per cent. better than the picoli money. Exchanges are always negotiated by the ducat banco, the par being 4s. $2\frac{1}{2}$d. ſterling, as in the table.

Though the ducat be commonly divided into 24 gros, yet bankers and negotiators, for facility of computation, uſually divide it as follows, and keep their books and accounts accordingly.

12 Deniers d'or, 20 Sols d'or } make { 1 ſol d'or; 1 ducat = $50\frac{1}{4}$d. ſterling.

The courſe of exchange is from 45d. to 55d. ſterling per ducat.

Examp. 1. How much ſterling money is equal to 1459 ducats 18 ſols 1 denier, bank money of Venice, exchange at $52\frac{3}{4}$ ſterling per ducat?

Duc. *d.*	*Duc.* *ſol.* *den.*		*d.*
If 1 : $52\frac{1}{4}$ ::	1459 18 1		$52\frac{1}{4}$ rate.
$52\frac{1}{4}$		*Sols.*	
2918		10 = $\frac{1}{2}$	$26\frac{3}{8}$
7295		5 = $\frac{1}{4}$	$13\frac{1}{8}$
		2 = $\frac{1}{10}$	$5\frac{2}{8}$
		1 = $\frac{1}{20}$	$2\frac{5}{8}$
d. 75868		den. 1 = $\frac{1}{240}$	$0\frac{2}{8}$
$\frac{1}{2}$ = 729$\frac{4}{8}$			
$\frac{1}{4}$ = 364$\frac{6}{8}$			$47\frac{5}{8}$
76962$\frac{2}{8}$			
$47\frac{5}{8}$			
Rem.			
12)77010(6d.			
20)6417(17s.			
L. 320 17 6 ſterling. *Anſ.*			

2. How many ducats at Venice are equal to 385l. 12s. 6d. ſterling, exchange at 4s. 4d. per ducat? Exchange

L.	*Duc.*	*L.*
If .216 :	1 ::	385.625
	.216)385.625	
	21	385.625
		Duc.
195)347062.5(1779.8 *Anſ.*		
195		
1520		
1365		
1556		
1365		
1912		
1755		
1575		
1560		
(15)		

Bank money is reduced to current money, by allowing for the agio, as was done in exchange with Holland; viz. ſay, As 100 to 120, or as 10 to 12, or as 5 to 6, ſo the given bank money to the current ſought. And current money is reduced to bank money by reverſing the operation. And in like manner may picoli money be reduced to current or to bank money, and the contrary.

100 ducats banco of Venice.

In Leghorn = 73 pezzos	In Lucca = 77 crowns
In Rome = $68\frac{1}{2}$ crowns	In Francfort = $139\frac{1}{2}$ florins

VII. *Exchange with Genoa.*

Money Table.

12 Denari, 20 Soldi } make { 1 foldi = *s.* *d.*; 1 pezzo = 4 6 ſterling.

Books and accounts are generally kept in pezzos, ſoldi, and denari; but ſome keep them in livres, ſoldi, and denari; and 12 ſuch denari make 1 ſoldi, and 20 ſoldi make 1 lire.

The pezzo of exchange is equal to $5\frac{3}{4}$ lires; and, conſequently exchange money is $5\frac{3}{4}$ times better than the lire money. The courſe of exchange runs from 47d. to 58d. ſterling per pezzo.

Examp. How much ſterling money is equivalent to 3390 pezzos 16 ſoldi of Genoa, exchange at $51\frac{7}{8}$d. ſterling per pezzo?

Soldi. *d.*	*Pez.* *ſoldi.*
If 20 : $51\frac{7}{8}$ ::	3390 16
8	20
415	
160	67816
	415
	339080
	67816
	271264
d.	*L.* *s.* *d.*
160)28143640(175897$\frac{1}{2}$	= 732 18 $1\frac{1}{2}$

Exchange. If ſterling money be given, it may be reduced or changed into pezzos of Genoa, by reverſing the former operation.

Exchange money is reduced to lire money, by being multiplied by $5\frac{1}{4}$, as follows:

Pez.	*ſoldi.*	Decimally.
3390	16	3390.8
	$5\frac{1}{4}$	5·75
16954	0	169540
$\frac{1}{4}$ = 1695	8	237356
$\frac{1}{2}$ = 847	14	169540
Lires 19497	2	Lires 19497.100

And lire money is reduced to exchange money by dividing it by $5\frac{1}{4}$.

In Milan, 1 crown = 80
In Naples, 1 ducat = 86
In Leghorn, 1 piaſtre = 20
In Sicily, 1 crown = $127\frac{2}{9}$

VIII. *Exchange with Leghorn.*

Money Table.

12 Denari, 20 Soldi } make { 1 ſoldi *s. d. Ster.*; 1 piaſtre = 4 6

Books and accounts are kept in piaſtres, ſoldi, and denari. The piaſtre here conſiſts of 6 lires, and the lire contains 20 ſoldi, and the ſoldi 12 denari; and conſequently exchange money is 6 times better than lire money. The courſe of exchange is from 47d. to 58d. ſterling per piaſtre.

Example. What is the ſterling value of 731 piaſtres, at $55\frac{1}{2}$ each?

s.	*d.*	731 piaſtres, at $55\frac{1}{2}$d.		
4 or	48 = $\frac{1}{5}$	146	4	
	6 = $\frac{1}{8}$	18	5	6
	$1\frac{1}{2}$ = $\frac{1}{4}$	4	11	$4\frac{1}{2}$
L.		169	0	$10\frac{1}{2}$ *Anſ.*

Sterling money is reduced to money of Leghorn, by reverſing the former operation; and exchange money is reduced to lire money by multiplying by 6, and lire money to exchange money by dividing by 6.

100 piaſtres of Leghorn are
In Naples = 134 ducats | In Geneva = $185\frac{1}{3}$ crowns.

Soldi of Leghorn.

In Sicily, 1 crown = $133\frac{1}{3}$
In Sardinia, 1 dollar = $95\frac{5}{9}$

The above are the chief places in Europe with which Britain exchanges directly; the exchanges with other places are generally made by bills on Hamburgh, Holland, or Venice. We ſhall here, however, ſubjoin the par of exchange betwixt Britain and moſt of the other places in Europe with which ſhe has any commercial intercourſe.

Par in Sterling.				*L.*	*s.*	*d.*
Rome,	1	crown	=	0	6	$1\frac{1}{3}$
Naples,	1	ducat	=	0	3	$4\frac{1}{2}$
Florence,	1	crown	=	0	5	$4\frac{5}{8}$
Milan,	1	ducat	=	0	4	7
Bologna,	1	dollar	=	0	4	3
Sicily,	1	crown	=	0	5	0
Vienna,	1	rixdollar	=	0	4	8
Augſburgh,	1	florin	=	0	3	$1\frac{1}{3}$
Francfort,	1	florin	=	0	3	0
Bremen,	1	rixdollar	=	0	3	6
Breſlau,	1	rixdollar	=	0	3	3
Berlin,	1	rixdollar	=	0	4	0
Stetin,	1	mark	=	0	1	6
Embden,	1	rixdollar	=	0	3	6
Bolſenna,	1	rixdollar	=	0	3	8
Dantzic,	$13\frac{1}{2}$	florins	=	1	0	0
Stockholm,	$34\frac{4}{7}$	dollars	=	1	0	0
Ruſſia,	1	ruble	=	0	4	5
Turkey,	1	aſper	=	0	4	6

Exchange.

The following places, viz. Switzerland, Nuremburgh, Leipſic, Dreſden, Oſnaburgh, Brunſwic, Cologn, Liege, Straſburgh, Cracow, Denmark, Norway, Riga, Revel, Narva, exchange with Britain, when direct exchange is made, upon the rixdollar, the par being 4s. 6d. ſterling.

IX. *Exchange with America and the Weſt Indies.*

In North America and the Weſt Indies, accounts, as in Britain, are kept in pounds, ſhillings, and pence. In North America they have few coins circulating among them, and on that account have been obliged to ſubſtitute a paper currency for a medium of their commerce; which having no intrinſic value, is ſubjected to many diſadvantages, and generally ſuffers a great diſcount. In the Weſt Indies coins are more frequent, owing to their commercial intercourſe with the Spaniſh ſettlements.

Exchange betwixt Britain and America, or the Weſt Indies, may be computed as in the following examples:

1. The neat proceeds of a cargo from Britain to Boſton amount to 845l. 17s. 6d. currency: How much is that in ſterling money, exchange at 80 per cent?

If 180 : 100
18 : 10
9 : 5 :: 845 17 6
5
9)4229 7 6
L. 469 18 $7\frac{1}{3}$ Ster. *Anſ.*

2. Boſton remits to Britain a bill of 469l 18s. $7\frac{1}{3}$d. ſterling: How much currency was paid for the bill at Boſton, exchange at 80 per cent.?

If 100 : 180
5 : 9 :: *L.* 469 18 $7\frac{1}{3}$
9
5)4229 7 6
845 17 6 currency. *Anſ.*

3. How much ſterling money will 1780l. Jamaica currency amount to, exchange to 40 per cent.?

If

Exchange.

If 140 : 100
14 : 10 L.
7 : 5 : : 1780
5
7)8900
s. d.
1271 8 6½ Ster. *Anſ.*

Bills of exchange from America, the rate being high, is an expenſive way of remitting money to Britain; and therefore merchants in Britain generally chooſe to have the debts due to them remitted home in ſugar, rum, or other produce.

X. *Exchange with Ireland.*

At Dublin, and all over Ireland, books and accounts are kept in pounds, ſhillings, and pence, as in Britain; and they exchange on the 100l. ſterling.

The par of one ſhilling ſterling is one ſhilling and one penny Iriſh; and ſo the par of 100l. ſterling is 108l. 6s. 8d. Iriſh. The courſe of exchange runs from 6 to 15 per cent.

Examp. 1. London remits to Dublin 586l. 10s. ſterling: How much Iriſh money will that amount to, exchange at 9⅝ per cent.

L.
If 100 : 109⅝ : : 586.5
8 877
800 : 877 41055
41055
46920
800)514360.5
642.950625
Anſ. 642l. 19s. Iriſh.

By practice.

p. cent.	586.5
10 = 1/10	58.65
2 = 1/5	11.75 ſub.
8 =	46.92
1 = 1/8	5.865
4/8 = 1/2	2.9325
1/8 = 1/4	.733125
9⅝	56.450625 add.
	642.950625

2. How much ſterling will 625l. Iriſh amount to, exchange at 10⅛ per cent.?

If 110⅛ : 100 : : 625
8 800
883 800 883)500000(566 5 0⅞ Ster. *Anſ.*
L. s. d.

XI. *Exchange betwixt London and other places in Britain.*

The ſeveral towns in Britain exchange with London for a ſmall premium in favour of London; ſuch as, 1, 1⅛, &c. per cent. The premium is more or leſs, according to the demand for bills. Exchange.

Examp. Edinburgh draws on London for 860l. exchange at 1⅛ per cent.: How much money muſt be paid at Edinburgh for the bill?

L.
860

per cent.	
1 = 1/100	8 12
½ = 1/200	2 3
⅛ = 1/800	1 1 6
	11 16 6 premium.
	871 16 6 paid for the bill.

To avoid paying the premium, it is an uſual practice to take the bill payable at London a certain number of days after date: and in this way of doing, 73 days is equivalent to 1 per cent.

XII. *Arbitration of Exchanges.*

The courſe of exchange betwixt nation and nation naturally riſes or falls according as the circumſtances and balance of trade happen to vary. Now, to draw upon and remit to foreign places, in this fluctuating ſtate of exchange, in the way that will turn out moſt profitable, is the deſign of arbitration. Which is either ſimple or compound.

I. *Simple Arbitration.*

In ſimple arbitration the rates or prices of exchange from one place to other two are given; whereby is found the correſpondent price between the ſaid two places, called the *arbitrated price*, or *par of arbitration*; and hence is derived a method of drawing and remitting to the beſt advantage.

Examp. 1. If exchange from London to Amſterdam be 33s. 9d. per pound ſterling; and if exchange from London to Paris be 32d per crown; what muſt be the rate of exchange from Amſterdam to Paris, in order to be put on a par with the other two?

Ster. *Flem.* *Ster.*
s. *s.* *d.* *d.*
If 20 : 33 9 : : 32
12 12
230 405
32
810
1215
240)12960(54d. Flem. per crown. *Anſ.*

2. If exchange from Paris to London be 32d. ſterling per crown; and if exchange from Paris to Amſterdam be 54d. Flemiſh per crown: what muſt be the rate of exchange between London and Amſterdam, in order to be on a par with the other two?

If

Exchange.

	Ster. d.	Flem. d.	Ster. d.
If	32	54	240
	240		
	216		
	108		
	12	s.	d.

32)12960(405 (33 9 Flem. per l. Ster. *Anſ.*

From theſe operations it appears, that if any ſum of money be remitted, at the rates of exchange mentioned, from any one of the three places to the ſecond, and from the ſecond to the third, and again from the third to the firſt, the ſum ſo remitted will come home entire, without increaſe or diminution.

From the par of arbitration thus found, and the courſe of exchange given, is deduced a method of drawing and remitting to advantage, as in the following example.

3. If exchange from London to Paris be 32d. ſterling per crown, and to Amſterdam 405d. Flemiſh per pound ſterling: and if, by advice from Holland to France, the courſe of exchange between Paris and Amſterdam is fallen to 52d. Flemiſh per crown; what may be gained per cent. by drawing on Paris, and remitting to Amſterdam?

The par of arbitration between Paris and Amſterdam in this caſe by Ex. 1. is 54d. Flemiſh per crown. Work as under.

	d. St.	Cr.	L. St.	Cr.	
If	32	1	100	750	debit at Paris.
	Cr.	d.Fl.	C.	d.Fl.	
If	1	52	750	39000	credit at Amſterdam.
	d.Fl.	L.St.	d.Fl.	L.	s. d.Ster.
If	405	1	39000	96	5 $11\frac{1}{9}$ to be remitted.
			100		
				3	14 $0\frac{8}{9}$

But if the courſe of exchange between Paris and Amſterdam, inſtead of falling below, riſe about the par of arbitration, ſuppoſe to 56d. Flemiſh per crown; in this caſe if you propoſe to gain by the negotiation, you muſt draw on Amſterdam, and remit to Paris. The computation follows:

	L.St.	d.Fl.	L.St.	d.Fl.	
If	1	405	100	40500	debit at Amſterdam.
	d.Fl.	Cr.	d.Fl.	Cr.	
If	56	1	40500	$723\frac{3}{14}$	credit at Paris.
	Cr.	d.St.	Cr.	L.	s. d. Ster.
If	1	32	$723\frac{3}{14}$	96	8 $6\frac{6}{7}$ to be remitted.
				100	
				3	11 $5\frac{1}{7}$ gained per cent.

In negotiations of this ſort, a ſum for remittance is afforded out of the ſum you receive for the draught; and your credit at the one foreign place pays your debt at the other.

II. *Compound Arbitration.*

In compound arbitration the rate or price of exchange between three, four, or more places, is given, in order to find how much a remittance paſſing through them all will amount to at the laſt place; or to find the arbitrated price, or par of arbitration, between the firſt place and the laſt. And this may be done by the following

Exchange.

RULES. I. Diſtinguiſh the given rates or prices into antecedents and conſequents; place the antecedents in one column, and the conſequents in another on the right, fronting one another by way of equation.

II. The firſt antecedent, and the laſt conſequent to which an antecedent is required, muſt always be of the ſame kind.

III. The ſecond antecedent muſt be of the ſame kind with the firſt conſequent, and the third antecedent of the ſame kind with the ſecond conſequent, &c.

IV. If to any of the numbers a fraction be annexed, both the antecedent and its conſequent muſt be multiplied into the denominator.

V. To facilitate the operation, terms that happen to be equal or the ſame in both columns, may be dropped or rejected, and other terms may be abridged.

VI. Multiply the antecedents continually for a diviſor, and the conſequents continually for a dividend, and the quot will be the anſwer or antecedent required.

EXAMP. 1. If London remit 1000l. ſterling to Spain, by way of Holland, at 35s. Flemiſh per pound ſterling; thence to France, at 58d. Flemiſh per crown; thence to Venice, at 100 crowns per 60 ducats: and thence to Spain, at 360 mervadies per ducat; how many piaſtres, of 272 mervadies, will the 1000l. ſterling amount to in Spain?

Antecedents.		*Conſequents.*	*Abridged.*
1l. Sterling	=	35s. or 420d. Fl.	1 = 210
58d. Flemiſh	=	1 crown France	29 = 1
100 crowns France	=	60 ducats Venice	1 = 30
1 ducat Venice	=	360 mervadies Spain	1 = 45
272 mervadies	=	1 piaſtre	17 = 1
How many piaſtres	=	1000l. ſterling	= 10

In order to abridge the terms, divide 58 and 420 by 2, and you have the new antecedent 29, and the new conſequent 210; reject two ciphers in 100 and 1000; divide 272 and 360 by 8, and you have 34 and 45: divide 34 and 60 by 2, and you have 17 and 30; and the whole will ſtand abridged as above.

Then, $29 \times 17 = 493$ diviſor; and $210 \times 30 \times 45 \times 10 = 2835000$ dividend; and, 493)2835000(5750$\frac{1}{2}$ piaſtres. *Anſ.*

Or, the conſequents may be connected with the ſign of multiplication, and placed over a line by way of numerator; and the antecedents, connected in the ſame manner, may be placed under the line, by way of denominator; and then abridged as follows:

$$\frac{420 \times 60 \times 360 \times 100}{58 \times 100 \times 272} = \frac{210 \times 60 \times 360 \times 10}{29 \times 1 \times 272}$$
$$= \frac{210 \times 60 \times 45 \times 10}{29 \times 34} = \frac{210 \times 30 \times 45 \times 10}{29 \times 17}$$
$$= \frac{2835000}{493},$$

And, 493)2835000(5750$\frac{1}{2}$ piaſtres. *Anſ.*

The placing the terms by way of antecedent and conſequent,

Exchange. fequent, and working as the rules direct, faves fo many ftatings of the rule of three, and greatly fhortens the operation. The proportions at large for the above queftion would be ftated as under.

L. St. d. Fl.	*L. St.*	*d. Fl.*
If 1 : 420 ::	1000 :	420000
d. Fl. Cr.	*d. Fl.*	*Cr.*
If 58 : 1 ::	420000 :	$7241\frac{1}{2}\frac{1}{9}$
Cr. Duc.	*Cr.*	*Duc.*
If 100 : 60 ::	$7241\frac{1}{2}\frac{1}{9}$:	$4344\frac{2}{2}\frac{4}{9}$
Duc. Mer.	*Duc.*	*Mer.*
If 1 : 360 ::	$4344\frac{2}{2}\frac{4}{9}$:	$1564137\frac{2}{2}\frac{7}{9}$
Mer. Piaſt.	*Mer.*	*Piaſt.*
If 272 : 1 ::	$1564137\frac{2}{2}\frac{7}{9}$	$5750\frac{2}{4}\frac{5}{9}\frac{6}{1}$

If we fuppofe the courfe of direct exchange to Spain to be $42\frac{1}{4}$d. fterling per piaftre, the 1000l. remitted would only amount to $5647\frac{1}{4}$ piaftres; and, conſequently, 103 piaſtres are gained by the negotiation; that is, about 2 per cent.

2. A banker in Amſterdam remits to London 400l. Flemiſh; firſt to France at 56d. Flemiſh per crown; from France to Venice, at 100 crowns per 60 ducats; from Venice to Hamburgh, at 100d. Flemiſh per ducat; from Hamburgh to Liſbon, at 50d. Flemiſh per cruſade of 400 rees; and, laſtly, from Liſbon to London at 64d. ſterling per millree: How much ſterling money will the remittance amount to? and how much will be gained or ſaved, ſuppoſing the direct exchange from Holland to London at 36s. 10d. Flemiſh per pound ſterling?

Antecedents.		*Conſequents.*
36d. Flem.	=	1 crown.
100 crowns	=	60 ducats.
1 ducat	=	100d. Flem.
50d. Flem.	=	400 rees.
1000 rees	=	64d. ſterling.
How many d. ſter.	=	400l. or 96000d. Flemiſh?

This, in the fractional form, will ſtand as follows.

$$\frac{60\times100\times400\times64\times96000}{65\times100\times50\times1000}=\frac{368640}{7}, \text{ and}$$

7)368640(52662$\frac{6}{7}$d. ſter.=219l. 8s. $6\frac{6}{7}$d. ſter. *Anſ.*

To find how much the exchange from Amſterdam directly to London, at 36s. 10d. Flemiſh per l. ſterling, will amount to, ſay,

s.	*d.*		*d. Fl.*	*L. St.*	*d. Fl.*		*L.*	*s.*	*d. St.*
36	10	If	442 : 1 ::	96000	:		217	3	$10\frac{1}{2}$
12							219	8	$6\frac{1}{4}$
442						Gained or ſaved,	2	4	$8\frac{1}{4}$

In the above example, the par of arbitration, or the arbitrated price, between London and Amſterdam, viz. the number of Flemiſh pence given for 1l. ſterling, may be found thus:

Make 64d. ſterling, the price of the millree, the firſt antecedent; then all the former conſequents will become antecedents, and all the antecedents will become conſequents. Place 240, the pence in 1l. ſterling, as the laſt conſequent, and then proceed as taught above, viz.

Exchange.

Antecedents.		*Conſequents.*
64d. ſter.	=	1000 rees.
400 rees	=	50d. Flem.
100d. Flem.	=	1 ducat.
60 ducats	=	100 crowns.
1 crown	=	56d. Flem.
How many d. Flem.	=	240 ſter.?

$$\frac{1000\times50\times100\times56\times240}{64\times400\times100\times60}=\frac{875}{2}, \text{ and}$$

2)875(437$\frac{1}{2}$d.=36s. $5\frac{1}{2}$d. Flem. per l. ſter. *Anſ.*

Or the arbitrated price may be found from the anſwer to the queſtion, by ſaying

d. Ster. d. Flem. d. St.

If $\frac{368640}{7}$: 96000 :: 240

7

672000

240

2688

1344

d. s. d. Flem.

368640)161280000(437$\frac{1}{2}$=36 $5\frac{1}{2}$ as before.

The work may be proved by the arbitrated price thus: As 1l. ſterling to 36s. $5\frac{1}{2}$d. Flemiſh, ſo 219l. 8s. $6\frac{6}{7}$d. ſterling to 400l. Flemiſh.

The arbitrated price compared with the direct courſe ſhows whether the direct or circular remittance will be moſt advantageous, and how much. Thus the banker at Amſterdam will think it better exchange to receive 1l. ſterling for 36s. $5\frac{1}{2}$d. Flemiſh, than for 36s. 10d. Flemiſh.

Exchange, ſignifies alſo a place in moſt conſiderable trading cities, wherein the merchants, negotiants, agents, bankers, brokers, interpreters, and other perſons concerned in commerce, meet on certain days, and at certain times thereof, to confer and treat together of matters relating to exchanges, remittances, payments, adventures, aſſurances, freightments, and other mercantile negotiations, both by ſea and land.

In Flanders, Holland, and ſeveral cities of France, theſe places are called *burſes;* at Paris and Lyons, *places de change*; and in the Hanſe towns, *colleges of merchants*. Theſe aſſemblies are held with ſo much exactneſs, and merchants and negotiants are ſo indiſpenſably required to attend at them, that a perſon's abſence alone makes him be ſuſpected of a failure or bankruptcy. The moſt conſiderable exchanges in Europe, are that of Amſterdam; and that of London, called the *Royal Exchange*.

Even in the time of the ancient Romans, there were places for the merchants to meet, in moſt of the conſiderable cities of the empire. That ſaid by ſome to have been built at Rome in the year of the city 259, 493 years before our Saviour, under the conſulate of Appius Claudius and Publius Servilius, was called *collegium mercatorium;* whereof it is pretended there are ſtill ſome remains, called by the modern Romans *loggia*, the lodge; and now uſually the place of St George. This notion of a Roman exchange is ſuppoſed to be

founded.

Exchange

founded on the authority of Livy, whose words are as follows: viz. *Certamen consulibus inciderat, uter dedicaret Mercurii ædem. Senatus à se rem ad populum rejicit: utri eorum dedicatio jussu populi data esset, eum præesse annonæ, mercatorum collegium instituere jussit.* Liv. lib. ii. But it must be here remarked, that *collegium* never signified a building for a society in the purer ages of the Latin tongue; so that *collegium mercatorium instituere* must not be rendered to build an exchange for the merchants, but to incorporate the merchants into a company. As Mercury was the god of traffick, this *ædes Mercurii* seems to have been chiefly designed for the devotions of this company or corporation.

Exchange.

EXCHANGE, *Bills of.* The following information concerning the origin of bills of exchange is extracted from Beckmann's History of Inventions.

"I shall not here repeat (says he) what has been collected by many learned men respecting the important history of this noble invention, but only lay before my readers an ordinance of the year 1394, concerning the acceptance of bills of exchange, and also two bills of the year 1404, as they may serve to illustrate farther what has been before said on the subject by others. These documents are, indeed, more modern than those found by Raphael de Turre in the writings of the jurist Baldus, which are dated March the 9th 1328; but they are attended with such circumstances as sufficiently prove that the method of transacting business by bills of exchange was fully established so early as the fourteenth century; and that the present form and terms were even then used. For this important information I am indebted to Mr Von Martens, who found it in a book which, as far as I know, has never been noticed in any literary journal, though it is much more deserving of attention than many others better known. It is a history, written in Spanish, of the maritime trade and other branches of commerce at Barcelona, taken entirely from the archives of that city, and accompanied with documents from the same source, which abound with matter highly interesting (A).

"Among these is an ordinance issued by the city of Barcelona in the year 1394, that bills of exchange should be accepted within twenty-four hours after they were presented; and that the acceptance should be written on the back of the bill.

"In the year 1404, the magistrates of Bruges, in Flanders, requested the magistrates of Barcelona to inform them what was the common practice, in regard to bills of exchange, when the person who presented a bill raised money on it in an unusual manner, in the case of its not being paid, and by these means increased the expences so much that the drawer would not consent to sustain the loss. The bill which gave occasion to this question is inserted in the memorial. It is written in the short form still used; which certainly seems to imply great antiquity. It speaks of usance; and it appears that first and second bills were at that time drawn, and that when bills were not accepted, it was customary to protest them.

"As this article is of great importance I shall here transcribe it, from vol. ii. p. 203: "Cum de mensibus Aprilis et Maii ultimo elapsis Antonius Quarti, mercator Lucanus residens in villa Burgensi, a Joanne Colom, mercatore civitatis Barchinonæ, etiam residente in prædicta villa Brugensi, duo millia scutorum Philippi, quolibet scuto pro xxii grossis computato, solvendi per Franciscum de Prato mercatorem Florentiæ, more solito, in Barchinona, mediatim Petro Gilberto et Petro Olivo, et mediatim Petro Scorp, et supradicto Petro Gilberto, mercatoribus Cardonæ: prout de dictis cambiis apparet quatuor litteris papireis, quarum tenores subsequuntur.

"Superscriptio autem primæ litteræ fuit talis: *Franc. do Prato et comp. à Barselona.* Tenor vero eiusdem ad intra fuit talis: *Al nome di Dio, Amen. à di* xxviii. *Aprile* 1404. *Pagate per questa prima di camb. à usanza à Piero Gilberto, è Piero Olivò scuti mille à sold.* x. *Barseloneſi per scuto, i quali scuti mille sono per cambio che con Giovani Colombo à grossi* xxii. *di g. scuto: et pag. à nostro conto, et Christo vi guardi.* Subtus vero erat scriptum: *Antonio Quarti Sal. de Bruggias.*

"Superscriptio vero secundæ litteræ fuit talis: *Francisco de Prato et comp. à Barselona.* Et ab intra sic habebatur: *Al nome de Dio, Amen. à di* xviii. *di Magio* 1404. *Pagate per questa prima di camb. à usanza à Piero Gilberto et à P. de Scorpo scuti mille de Felippo à sold.* x. *Barseloneſi per scuto: i quali scuti mille sono per camb. che con Giov. Colombo à grossi* xxii. *di g. scuto: et pag. à nostro conto: et Christo vi guardi.* Subtus vero erat sic scriptum: *Ant. Quadri Sal. de Bruggias.*"* * Vol. iii p. 469.

Bills of exchange are justly considered as of the greatest importance to the interest of commerce; but several queries have been proposed respecting them, which do not as yet appear to have received a satisfactory solution. It still seems to be a disputed point, whether the law ought to consider them as nothing more than a deposit belonging to the drawer, and successively confided to the remittees; or as property capable of being transferred, and entirely vested in the holder at all times, who should be alone responsible for neglecting it, when its value is vitiated.

Professor Busch of Hamburgh thought that bills of exchange should always be viewed as the exclusive property of the person holding them, which, in a work published

(A) "*Memorias historicas sobre la marina commercio y artes de la antigua ciudad de Barcelona, por D. Antonio de Capmany y de Montpalau.* Madrid 1779, 2 vol. 4to. As a proof of what I have said above, I shall mention the following important articles, which may be found in this work. A custom-house tariff, written in Latin, of the year 1221, in which occur a great number of remarkable names and articles of merchandise not explained. Another of the like kind of the year 1252. Letters of power to appoint consuls in distant countries, such as Syria, Egypt, &c. dated in the years 1266, 1268, and 1321. An ordinance of the year 1458, respecting insurance, which required that under-writing should be done in the presence of a notary, and declared *polices ò scriptures privades* to be null and void. A *privilegium* of the emperor Andronicus II. to the merchants of Barcelona, written in Greek and Spanish, in 1290. Account of the oldest Spanish trade with wool, silk, salt, and saffron; and of the oldest guilds or incorporated societies of tradesmen at Barcelona, &c."

Exchequer. publiſhed in 1792, is defended by a number of plauſible arguments. This theory was applied to the difficult and fluctuating caſe of the holder of a bill which has ſeveral indorſements, where the drawer, the drawee, and perſons early indorſing it, have all become bankrupts. Should the perſon holding it under each bankruptcy prove the entire amount of ſaid bill, it is manifeſt that he muſt receive much more than he can in juſtice claim as his due. It ſeems moſt equitable that he ſhould be forced to prove his debt againſt none but his immediate predeceſſor, the aſſignees of ſuch predeceſſor being allowed a ſimilar proof up to the drawer. To ſuch as are frequently in the habit of diſcounting bills, from their commercial ſituations in life, this becomes a matter of the utmoſt conſequence; for farther information concerning which, we refer our readers to the ingenious work of Profeſſor Buſch already alluded to, and to *Additions to the Theoretical and Practical Delineation of Commerce*, publiſhed in 1798 (B).

EXCHEQUER, in the Britiſh juriſprudence, an ancient court of record, in which all cauſes concerning the revenues and rights of the crown are heard and determined, and where the crown revenues are received. It took this name from the cloth that covered the table of the court, which was party-coloured, or chequered.

This court is ſaid to have been erected by William the Conqueror, its model being taken from a like court eſtabliſhed in Normandy long before that time. Anciently its authority was ſo great, that it was held in the king's palace, and the acts thereof were not to be examined or controlled in any other of the king's courts; but, at preſent, it is the laſt of the four courts at Weſtminſter.

In the exchequer, ſome reckon ſeven courts, viz. thoſe of pleas, accounts, receipts, exchequer-chamber (which is an aſſembly of all the judges on difficult matters in law), errors in the exchequer, errors in the king's bench, and, laſtly, the court of equity in the exchequer.

But the exchequer, for the deſpatch of buſineſs, is generally divided into two parts; one of which is chiefly converſant in the judicial hearing and deciding of all cauſes relating to the king's coffers, formerly termed the *exchequer of accounts*: the other is called the *receipt of the exchequer*, as being principally employed in receiving and paying of money.

Officers of the receipt may take one penny in the pound, as their fee, for ſums iſſued out; and they are obliged, without delay, to receive the money brought thither; and the money received is to be put into cheſts under three different locks and keys, kept by three ſeveral officers. All ſheriffs, bailiffs, &c. are to account in the exchequer; and in the lower part, termed the receipt, the debtors of the king, and perſons in debt to them, the king's tenants, and the officers and miniſters of the court, are privileged to ſue one another, or any ſtranger, and to be ſued in the like actions as are brought in the courts of king's bench and common pleas. Exchequer.

The judicial part of the exchequer, is a court both of law and equity. The court of law is held in the office of pleas, according to the courſe of common law, before the barons: in this court, the plaintiff ought to be a debtor or accountant to the king: and the leading proceſs is either a writ of ſubpœna, or quo minus, which laſt goes into Wales, where no proceſs out of courts of law ought to run, except a capias utlagatum.

The court of equity is held in the exchequer chamber, before the treaſurer, chancellor, and barons; but generally, before the barons only: the lord chief baron being the chief judge to hear and determine all cauſes. The proceedings of this part of the exchequer are by Engliſh bill and anſwer, according to the practice of the court of chancery; with this difference that the plaintiff here muſt ſet forth, that he is a debtor to the king, whether he be ſo or not. It is in this court of equity that the clergy exhibit bills for the recovery of their tythes, &c. Here too the attorney-general exhibits bills for any matters concerning the crown; and a bill may be exhibited againſt the king's attorney by any perſon aggrieved in any cauſe proſecuted againſt him on behalf of the king, to be relieved therein: in which caſe, the plaintiff is to attend on the attorney general, with a copy of the bill, and procure him to give an anſwer thereto; in the making of which he may call in any perſon intereſted in the cauſe, or any officer, or others, to inſtruct him, that the king be not prejudiced thereby; and his anſwer is to be put in without oath.

But, beſides the buſineſs relating to debtors, farmers, receivers, accountants, &c. all penal puniſhments, intruſion, and forfeitures upon popular actions, are mat-

(B) In Vol. III. p. 613. under the article Bill, the old duty on ſtamps is mentioned, and the new entirely omitted.

The following are the duties on ſuch ſtamps for the year 1805. The duty on promiſſory notes for the payment of money to the bearer on demand, for a ſum not exceeding 1l. 1s. is 3d. For a ſum exceeding 1l. 1s. and not 2l. 2s.; 6d. For a ſum exceeding 2l. 2s. and not 5l. 5s.; 9d. For a ſum exceeding 5l. 5s. and not 20l.; 1s.

Promiſſory notes by the Bank or Royal Bank of Scotland, or the Britiſh Linen Company, payable to the bearer on demand, which may within three years after the date be reiſſued after payment, when the ſum amounts to, and ſhall not exceed 100l.; 5s.

Bill of exchange, draft, order, or promiſſory or other note, payable to the bearer on demand, for 40s. and not exceeding 5l. 5s.; 8d.—Otherwiſe than to the bearer on demand, when the ſum ſhall amount to 40s. and ſhall not exceed 5l. 5s.; 1s.

Bills of exchange, draft, order, or promiſſory note for the payment of money, where the ſum ſhall exceed 5l. 5s. and not 30l.; 1s. 6d. Exceeding 30l. and not 50l.; 2s. Above 50l. and not 100; 3s. Above 100l. and not 200l; 4s. Above 200l. and not 500l.; 5s. Above 500l. and not 1000l.; 7s. 6d.

Foreign bills of exchange drawn in ſets, where the ſum ſhall not exceed 100l. for each bill in each ſet, 1s. Exceeding 100l. and not 200l.; 2s. Exceeding 200l. and not 500l.; 3s. Exceeding 500l. and not 1000l.; 4s.

Exchequer, Excise.

ters likewise cognizable by this court; where there also sits a puisne-baron, who administers the oaths to high sheriffs, bailiffs, auditors, receivers, collectors, comptrollers, surveyors, and searchers of all the customs, &c.

The exchequer in Scotland has the same privileges and jurisdiction as that of England; and all matters competent to the one are likewise competent to the other.

Black Book of the EXCHEQUER, is a book under the keeping of the two chamberlains of the exchequer; said to have been composed in 1175 by Gervais of Tilbury, nephew of King Henry II. and divided into several chapters. Herein is contained a description of the court of England, as it then stood, its officers, their ranks, privileges, wages, perquisites, power, and jurisdiction; and the revenues of the crown, both in money, grain, and cattle. Here we find, that for one shilling, as much bread might be bought as would serve 100 men a whole day; that the price of a fat bullock was only 12 shillings, and a sheep four, &c.

Chancellor of the EXCHEQUER. See CHANCELLOR.

Exchequer Bills. By statute 5 Ann. c. 13. the lord treasurers may cause exchequer bills to be made of any sums not exceeding 1,500,000l. for the use of the war; and the duties upon houses were made chargeable with 4l. 10s. per cent. per annum to the bank for circulating them. The bank not paying the bills, actions to be brought against the Company, and the money and damages recovered: and if any exchequer bills be lost, upon affidavit of it before a baron of the exchequer, and certificate from such baron, and security to pay the same if found, duplicates are to be made out: also when bills are defaced, new ones shall be delivered. The king, or his officers in the exchequer, by former statutes, might borrow money upon the credit of bills, payable on demand, with interest after the rate of 3d. per diem for every 100l. bill. And by 8 and 9 W. III. c. 20. an interest of 5d. a day was allowed for every 100l. But 12 W. III. c. 1. lowered the interest on these bills to 4d. a-day per cent. And by 12 Ann, c. 11. it is sunk to 2d. a-day. Forging exchequer bills, or the indorsements thereof, is felony.

EXCISE, (from the Belgic *accijfe*, tributum, "tribute,") an inland duty or imposition, paid sometimes upon the consumption of the commodity, or frequently upon the wholesale, which is the last stage before the consumption. This is doubtless, impartially speaking, the most economical way of taxing the subject; the charges of levying, collecting, and managing the excise duties, being considerably less in proportion than in other branches of the revenue. It also renders the commodity cheaper to the consumer, than charging it with customs to the same amount would do; for the reason just now given, because generally paid in a much later stage of it. But, at the same time, the rigour and arbitrary proceedings of excise laws seem hardly compatible with the temper of a free nation. For the frauds that might be committed in this branch of the revenue, unless a strict watch is kept, make it necessary, wherever it is established, to give the officers a power of entering and searching the houses of such as deal in exciseable commodities, at any hour of the day, and, in many cases, of the night likewise. And the proceedings, in case of transgressions, are so summary and sudden, that a man may be convicted in two days time in the penalty of many thousand pounds, by two commissioners or justices of the peace; to the total exclusion of the trial by jury, and disregard of the common law. For which reason, though Lord Clarendon tells us, that to his knowledge the earl of Bedford (who was made lord treasurer by King Charles I. to oblige his parliament) intended to have set up the excise in England, yet it never made a part of that unfortunate prince's revenue; being first introduced, on the model of the Dutch prototype, by the parliament itself after its rupture with the crown. Yet such was the opinion of its general unpopularity, that when in 1642 "aspersions were cast by malignant persons upon the house of commons, that they intended to introduce excises, the house for its vindication therein did declare, that these rumours were false and scandalous, and that their authors should be apprehended and brought to condign punishment." Its original establishment was in 1643, and its progress was gradual; being at first laid upon those persons and commodities where it was supposed the hardship would be least perceivable, viz. the makers and venders of beer, ale, cyder, and perry; and the royalists at Oxford soon followed the example of their brethren at Westminster, by imposing a similar duty: both sides protesting that it should be continued no longer than to the end of the war, and then be utterly abolished. But the parliament at Westminster soon after imposed it on flesh, wine, tobacco, sugar, and such a multitude of other commodities, that it might be fairly denominated *general:* in pursuance of the plan laid down by Mr Pymme (who seems to have been the father of the excise), in his letter to Sir John Hotham, signifying, "that they had proceeded in the excise to many particulars, and intended to go on farther; but that it would be necessary to use the people to it by little and little."—And afterwards, when the nation had been accustomed to it for a series of years, the succeeding champions of liberty boldly and openly declared "the impost of excise to be the most easy and indifferent levy that could be laid upon the people;" and accordingly continued it during the whole usurpation. Upon King Charles's return, it having then been long established, and its produce well known, some part of it was given to the crown, in 12 Car. II. by way of purchase for the feudal tenures and other oppressive parts of the hereditary revenue. But, from its first original to the present time, its very name has been odious to the people. It has, nevertheless, been imposed on abundance of other commodities in the reigns of King William III. and every succeeding prince, to support the enormous expences occasioned by our wars on the continent. Thus brandies and other spirits are now excised at the distillery; printed silks and linens, at the printers; starch and hair powder, at the makers; gold and silver wire, at the wiredrawers; all plate whatsoever, first in the hands of the vender, who pays yearly for a license to sell it, and afterwards in the hands of the occupier, who also pays an annual duty for having it in his custody; and coaches and other wheel-carriages, for which the occupier is excised; though not with the same circumstances of arbitrary strictness with regard to plate and coaches as in the other instances. To these we may add coffee and tea, chocolate and cocoa paste, for which the duty

Excise.

Exciſion || Excommunication.

ty is paid by the retailer; all artificial wines, commonly called *ſweets*; paper and paſteboard, firſt when made, and again if ſtained or printed; malt, as before mentioned; vinegars; and the manufacture of glaſs; for all which the duty is paid by the manufacturer; hops, for which the perſon that gathers them is anſwerable; candles and ſoap, which are paid for at the makers; malt liquors brewed for ſale, which are exciſed at the brewery; cyder and perry at the venders; leather and ſkins, at the tanner's; and, lately, tobacco, at the manufacturer's: A liſt, which no friend to his country would wiſh to ſee farther increaſed.

The exciſe was formerly farmed out: but is now managed for the king by commiſſioners in both kingdoms, who receive the whole product of the exciſe, and pay it into the exchequer. Theſe commiſſioners are nine in number in England, and five in Scotland. The former have a ſalary of 1000l. a-year, the latter 600l. They are obliged by oath to take no fee or reward but from the king himſelf; and from them there lies an appeal to five other commiſſioners called *commiſſioners of appeals*.

EXCISION, in *Surgery*, the cutting out, or cutting off, any part of the body.

EXCISION, in a ſcripture ſenſe, means the cutting off of a perſon from his people, by way of puniſhment for ſome ſin by him committed. The Jews, Selden informs us, reckon 36 crimes, to which they pretend this puniſhment is due. The Rabbins reckon three kinds of exciſion; one, which deſtroys only the body; another, which deſtroys the ſoul only; and a third, which deſtroys both body and ſoul. The firſt kind of exciſion they pretend is an untimely death; the ſecond is an utter extinction of the ſoul; and the third, a compound of the two former: thus, making the ſoul mortal or immortal, ſays Selden, according to the degrees of miſbehaviour and wickedneſs of the people.

EXCLAMATION. See ORATORY, N° 85.

EXCLUSION, or *Bill of* EXCLUSION, a bill propoſed about the cloſe of the reign of King Charles II. for excluding the duke of York, the king's brother, from the throne, on account of his being a Papiſt.

EXCLUSIVE, is ſometimes uſed adjectively, thus; *A patent carries with it an excluſive privilege.* Sometimes adverbially: as, *He ſent him all the numbers from* N° 145 to N° 247 *excluſive*; that is, all between theſe two numbers, which themſelves were excepted.

EXCOECARIA, a genus of plants belonging to the dioecia claſs, and in the natural method ranking under the 38th order, *Tricoccæ*. See BOTANY *Index*.

EXCOMMUNICATION, an eccleſiaſtical penalty or cenſure, whereby ſuch perſons as are guilty of any notorious crime or offence, are ſeparated from the communion of the church, and deprived of all ſpiritual advantages.

Excommunication is founded on a natural right which all ſocieties have, of excluding out of their body ſuch as violate the laws thereof; and it was originally inſtituted for preſerving the purity of the church; but ambitious eccleſiaſtics converted it by degrees into an engine for promoting their own power, and inflicted it on the moſt frivolous occaſions.

The power of excommunication, as well as other acts of eccleſiaſtical diſcipline, was lodged in the hands of the clergy, who diſtinguiſhed it into the *greater* and *leſſer*. The leſſer excommunication, ſimply called *aphoriſmos*, "ſeparation or ſuſpenſion," conſiſted in excluding men from the participation of the euchariſt, and the prayers of the faithful. But they were not expelled the church; for they had the privilege of being preſent at the reading of the Scriptures, the ſermons, and the prayers of the catechumens and penitents. This excommunication was inflicted for leſſer crimes; ſuch as neglecting to attend the ſervice of the church, miſbehaviour in it, and the like. Excommunication

The greater excommunication, called *panteles aphoriſmos*, "total ſeparation and anathema," conſiſted in an abſolute and entire excluſion from the church and the participation of all its rites. When any perſon was thus excommunicated, notice of it was given by circular letters to the moſt eminent churches all over the world, that they might all confirm this act of diſcipline, by refuſing to admit the delinquent to their communion. The conſequences of this latter excommunication were very terrible. The excommunicated perſon was avoided in civil commerce and outward converſation. No one was to receive him into his houſe, nor eat at the ſame table with him; and when dead, he was denied the ſolemn rites of burial.

The Romiſh pontifical takes notice of three kinds of excommunication. 1. The minor, incurred by thoſe who have any correſpondence with an excommunicated perſon. 2. The major, which falls upon thoſe who diſobey the commands of the holy ſee, or refuſe to ſubmit to certain points of diſcipline; in conſequence of which they are excluded from the church militant and triumphant, and delivered over to the devil and his angels. 3. Anathema, which is properly that pronounced by the pope againſt heretical princes and countries. In former ages, theſe papal fulminations were moſt terrible things; but at preſent, they are formidable to none but a few petty ſtates of Italy.

Excommunication, in the Greek church, cuts off the offender from all communion with the 318 fathers of the firſt council of Nice, and with the ſaints; conſigns him over to the devil and the traitor Judas; and condemns his body to remain after death as hard as a flint or piece of ſteel, unleſs he humbles himſelf and makes atonement for his ſins by a ſincere repentance. The form abounds with dreadful imprecations; and the Greeks aſſert, that if a perſon dies excommunicated, the devil enters into the lifeleſs corps; and therefore, in order to prevent it, the relations of the deceaſed cut his body in pieces, and boil them in wine. It is a cuſtom for the patriarch of Jeruſalem annually to excommunicate the pope and the church of Rome; on which occaſion, together with a great deal of idle ceremony, he drives a nail into the ground with a hammer, as a mark of malediction.

The form of excommunication in the church of England anciently ran thus: By the authority of God the Father Almighty, the Son and Holy Ghoſt, and of Mary the bleſſed mother of God, we excommunicate, anathematize, and ſequeſter from the pale of holy mother church, &c." The cauſes of excommunication in England are, contempt of the biſhop's court, hereſy, neglect of public worſhip and the ſacraments, incontinency, adultery, ſimony, &c. It is deſcribed to be twofold. The leſs is an eccleſiaſtical cenſure,

Excommunication.

fure, excluding the party from the participation of the ſacraments: the greater proceeds farther, and excludes him not only from theſe, but from the company of all Chriſtians. But if the judge of any ſpiritual court excommunicates a man for a cauſe of which he hath not the legal cognizance, the party may have an action againſt him at common law, and he is alſo liable to be indicted at the ſuit of the king.

Heavy as the penalty of excommunication is, conſidered in a ſerious light, there are, notwithſtanding, many obſtinate or profligate men, who would deſpiſe the *brutum fulmen* of mere eccleſiaſtical cenſures, eſpecially when pronounced by a petty ſurrogate in the country, for railing or contumelious words, for non-payment of fees or coſts, or other trivial cauſe. The common law, therefore, compaſſionately ſteps in to their aid, and kindly lends a ſupporting hand to an otherwiſe tottering authority. Imitating herein the policy of the ancient Britons, among whom, according to Cæſar, whoever were interdicted by the druids from their ſacrifices, "In numero impiorum ac ſceleratorum habentur: ab iis omnes decedunt, aditum eorum ſermonemque defugiunt, ne quid ex contagione incommodi accipiant: neque eis petentibus jus redditur, neque honos ullus communicatur." And ſo with us, by the common law, an excommunicated perſon is diſabled to do any act that is required to be done by one that is *probus et legalis homo*. He cannot ſerve upon juries; cannot be a witneſs in any court; and, which is the worſt of all, cannot bring an action, either real or perſonal, to recover lands or money due to him. Nor is this the whole: for if, within 40 days after the ſentence has been publiſhed in the church, the offender does not ſubmit and abide by the ſentence of the ſpiritual court, the biſhop may certify ſuch contempt to the king in chancery. Upon which there iſſues out a writ to the ſheriff of the county, called from the biſhop's certificate a *significavit*; or from its effect, a writ *de excommunicato capiendo*: and the ſheriff ſhall thereupon take the offender and impriſon him in the county jail, till he is reconciled to the church, and ſuch reconciliation certified by the biſhop; upon which another writ *de excommunicato deliberando*, iſſues out of chancery to deliver and releaſe him.

EXCOMMUNICATION was alſo practiſed among the Jews, who uſed to expel from their ſynagogue ſuch as had committed any grievous crime. See the Goſpel according to St John, ix. 22. xii. 42. xvi. 2. And Joſeph. Antiq. Jud. lib. ix. cap. 22. and lib. xvi. cap. 2.

Godwyn, in his *Moſes and Aaron*, diſtinguiſhes three degrees, or kinds, of excommunication among the Jews. The firſt he finds intimated in John ix. 22. The ſecond in 1 Cor. v. 5. And the third in 1 Cor. xvi. 22. See NIDDUI.

The rule of the Benedictines gives the name *excommunication* to the being excluded from the oratory, and the common table of the houſe, in our inns of court called *diſcommoning*. This was the puniſhment of ſuch monks as came too late.

EXCOMMUNICATION, or a being ſecluded from a participation in the myſteries of religion, was alſo in uſe under paganiſm.

Such as were thus excommunicated were forbidden to aſſiſt or attend at the ſacrifices, or to enter within the temples; and were afterwards delivered over to the demons and furies of hell, with certain imprecations; which was called among the Romands *diris devovere*. See EXECRATION.

Excoriation, Excrement.

The Druids among the ancient Britons and Gauls, likewiſe, made uſe of excommunication againſt rebels; and interdicted the communion of their myſteries to ſuch as refuſed to acquieſce in their deciſions. See DRUIDS.

EXCORIATION, in *Medicine* and *Surgery*, the galling, or rubbing off the cuticle, eſpecially of the parts between the thighs and about the anus. In adults, it is occaſioned by riding, much walking, or other vehement exerciſe, and may be cured by vulnerary applications. In children there is often an excoriation, not only of the parts near the pudenda, chiefly of the groin and ſcrotum, but likewiſe in the wrinkles of the neck, under the arms, and in other places; proceeding from the acrimony of urine and ſweat; and occaſioning itching pains, crying, watching, reſtleſſneſs, &c. To remedy this, the parts affected may be often waſhed with warm water, and ſprinkled with drying powders, as chalk, hartſhorn, but eſpecially tutty, lapis calaminaris, and ceruſs, which may be tied looſely in a rag, and the powder ſhook out on the parts.

EXCREMENT, whatever is diſcharged out of the body of animals after digeſtion; or the fibrous part of the aliment, mixed with the bile, ſaliva, and other fluids. Urine and the feces are the groſs excrements that are diſcharged out of the bladder or belly. Other excrements are the various humours that are ſecreted from the blood through the different ſtrainers in the body, and which ſerve for ſeveral uſes; ſuch as the ſaliva, ſweat, bile, the pancreatic juice, lymph, the ſemen, nails, the hair, the horns and hoofs of animals.

Alchemiſts, who have fought everywhere for their *great work*, as they called it, have particularly operated much on the excrements of men and other animals; but philoſophical chemiſtry has acquired no knowledge from all theſe alchemical labours, from the obſcurity with which their authors have deſcribed them. The philoſophic chemiſts have not much examined animal excrements. Of theſe, Homberg is the only one who has particularly analyzed and examined human ordure; and this was done to ſatisfy an alchemical project of one of his friends, who pretended that from this matter a white oil could be obtained, without ſmell, and capable of fixing mercury into ſilver. The oil was found by Homberg, but mercury was not fixed by it.

The labours of this able chemiſt were not, however uſeleſs, like thoſe of the alchemiſts; becauſe he has clearly related the experiments he made on this matter, in the Memoirs of the Academy of Sciences. Theſe experiments are curious, and teach ſeveral eſſential things concerning the nature of excrements. The reſult of theſe experiments is as follows: Freſh human feces, being diſtilled to dryneſs in a water bath, furniſh a clear, watery, inſipid liquor, of a diſagreeable ſmell, but which contains no volatile alkali; which is a proof that this matter, although nearly in a putrefactive ſtate, is not however putrefied; for all ſubſtances really putrid furniſh with this degree of heat a manifeſt volatile alkali *. The dry reſiduum of the foregoing experiment, being diſtilled in a retort with a graduated fire, furniſhes a volatile alkaline ſpirit and ſalt,

* See *Putrefaction.*

Excrescence || Excat.

salt, a fetid oil, and leaves a residuous coal. These are the same substances which are obtained from all animal matters.

Human feces, diluted and lixiviated in water, furnish by filtration and evaporation of the water an oily salt of a nitrous nature, which deflagrates like nitre upon ardent coals, and which inflames in close vessels when heated to a certain degree. The same matter yielded to Homberg, who treated it by a complete fermentation or putrefaction, excited by a digestion during 40 days in a gentle water-bath heat, and who afterwards distilled it, an oil without colour, and without bad smell, and such as he endeavoured to find; but which did not, as we said before, fix mercury into silver.

EXCRESCENCE, in *Surgery*, denotes every preternatural tumour which arises upon the skin, either in the form of a wart or tubercle. If they are born with a person, as they frequently are, they are called *nævi materni*, or marks from the mother; but if the tumour is large, so as to depend from the skin, like a fleshy mass, it is then called a *sarcoma*. See SURGERY.

EXCRETION, or SECRETION, in *Medicine*, a separation of some fluid, mixed with the blood, by means of the glands. Excretions, by which we mean those that evacuate superfluous and heterogeneous humours, purify the mass of blood: the humours which are generated in the blood are excreted by the glands, and are replaced by a sufficient quantity of aliment.

EXCRETORY, in *Anatomy*, a term applied to certain little ducts or vessels, destined for the reception of a fluid, secreted in certain glandules, and other viscera, for the excretion of it in the appropriated places.

EXCUBIÆ, in antiquity, the watches and guards kept in the day by the Roman soldiers. They are contradistinguished from the *vigiliæ* which were kept in the night. The *excubiæ* were placed either at the gates and intrenchments or in the camp; for the latter there was allowed a whole *manipulus* to attend before the *prætorium*, and four soldiers to the tent of every *tribune*. The *excubiæ* at the gates of the camp, and at the intrenchments, were properly called *stationes*. One company of foot and one troop of horse were assigned to each of the four gates every day. To desert their post, or abandon their corps of guards, was an unpardonable crime.

The *triarii*, as the most honourable order of soldiers, were excused from the ordinary watches; yet being placed opposite to the *equites*, they were obliged to have an eye over them.

LETTERS *of* EXCULPATION, in *Scots Law*, a writ or summons issued by authority of the court of justiciary, at the instance of a pannel, for citing witnesses to prove his defences, or his objections to any of the jury or witnesses cited against him.

EXCUSATI, in church history, a term used to denote slaves, who flying to any church for sanctuary, were excused and pardoned by their masters; but these were obliged to take an oath to that purpose before they could have them again; and, if they broke the oath, they were punished and fined as persons guilty of perjury.

EXEAT, in church discipline, a Latin term, used for a permission which a bishop grants a priest to go out of his diocese; or an abbot to a religious to go out of his monastery. Execration || Execution.

EXECRATION, in antiquity, a kind of punishment, consisting of direful curses and marks of infamy: such was that used against Philip king of Macedon by the Athenians. A general assembly of the people being called, they made a decree, that all the statues and images of that king, and of all his ancestors, should be demolished, and their very name razed; that all the festivals, sacred rites, priests, and whatever else had been instituted in honour of him, should be profaned; that the very places where there had been any monument or inscription to his honour, should be detestable; that nothing should be set up, or dedicated in them, which could be done in clean places; and, lastly, that the priests, as often as they prayed for the Athenian people, allies, armies, and fleets, should as many times detest and execrate Philip, his children, kingdom, land and sea forces, and the whole race and name of the Macedonians.

At the taking and demolishing of cities, it was usual amongst the Jews, Greeks, and Romans, to pronounce curses upon, and load with direful execrations, the rebuilders of them.

EXECUTION, in a general sense, the act of accomplishing, finishing, or achieving any thing.

EXECUTION, in *Law*, the completing or finishing some act, as of judgment, deed, &c. and it usually signifies the obtaining possession of any thing recovered by judgment of law.

Sir Edward Coke observes, that there are two sorts of executions: the one final; and the other a quousque, that tends to an end. An execution final, is that which makes money of the defendant's goods; or extends to his lands and delivers them to the plaintiff, who accepts the same in satisfaction; and this is the end of the suit, and the whole that the king's writ requires to be done. The writ of execution with a quousque, though it tends to an end, yet is not final, as in the case *capias ad satisfac.* where the defendant's body is to be taken, in order that the plaintiff may be satisfied for his debt. See CAPIAS.

Executions are either in personal, real, or mixed actions. In a personal action, the execution may be made three ways, viz. by the writs of *capias ad satisfaciendam*, against the body of the defendant; *fieri facias*, against his goods; or *elegit*, against his lands. See *FIERI Facias* and ELEGIT.

In a real and mixed action, the execution is by writ of *habere facias saſinam*, and *habere poſſeſſionem**. Writs of execution bind the property of goods only from the time of delivery of the writ to the sheriff; but the land is bound from the day of the judgment obtained: and here the sale of any goods for valuable consideration, after a judgment, and before the execution awarded, will be good. It is otherwise as to lands, of which execution may be made, even on a purchase after the judgment, though the defendant sell such land before execution. Likewise, sheriffs may deliver in execution all the lands whereof others shall be seized in trust for him against whom execution is had on a judgment, &c.

* See *Habere*.

When any judgment is signed, the execution may be taken out immediately thereon; but if it be not issued within a year and a day after, where there is no fault

Execution. fault in the defendant, as in the caſe of an injunction, writ of error, &c. there muſt be a *ſcire facias*, to revive the judgment; though, if the plaintiff ſues out any writ of execution within the year, he may continue it after the year is expired. After judgment againſt the defendant, in an action wherein ſpecial bail is given, the plaintiff is at liberty to have execution againſt ſuch defendant, or againſt his bail: but this is underſtood where the defendant does not render himſelf, according to law, in ſafeguard of the bail: and execution may not regularly be ſued forth againſt a bail, till a default is returned againſt the principal: alſo if the plaintiff takes the bail, he ſhall never take the principal. It is held that an execution may be executed after the death of the defendant: for his executor, being privy thereto, is liable, as well as the teſtator. The executor is an entire thing, ſo that he who begins muſt end it; therefore, a new ſheriff may diſtrain an old one, to ſell the goods ſeized on a diſtringas, and to bring the money into court.

EXECUTION, in criminal caſes, the completion of human puniſhment. This follows judgment †; and muſt in all caſes, capital as well as otherwiſe, be performed by the legal officer, the ſheriff or his deputy; whoſe warrant for ſo doing was anciently by precept under the hand and ſeal of the judges, as it is ſtill practiſed in the court of the lord high ſteward, upon the execution of a peer: though, in the court of the peers in parliament, it is done by writ from the king. Afterwards it was eſtabliſhed, that in caſe of life, the judge may command execution to be done without any writ. And now the uſage is, for the judge to ſign the kalendar or liſt of all the priſoners names, with their ſeparate judgments in the margin, which is left with the ſheriff. As, for a capital felony, it is written oppoſite to the priſoner's name, "let him be hanged by the neck:" formerly, in the days of Latin and abbreviation, "*ſuſ. per coll.*" for "*ſuſpendatur per collum.*" And this is the only warrant that the ſheriff has for ſo material an act as taking away the life of another. It may certainly afford matter of ſpeculation, that in civil cauſes there ſhould be ſuch a variety of writs of execution to recover a trifling debt, iſſued in the king's name, and under the ſeal of the court, without which the ſheriff cannot legally ſtir one ſtep; and yet that the execution of a man, the moſt important and terrible taſk of any, ſhould depend upon a marginal note.

† See *Judgment.*

Blackſt. Comment.

The ſheriff, upon receipt of his warrant, is to do execution within a convenient time; which in the country is alſo left at large. In London, indeed, a more ſolemn and becoming exactneſs is uſed, both as to the warrant of execution and the time of executing thereof: for the recorder, after reporting to the king in perſon the caſe of the ſeveral priſoners, and receiving his royal pleaſure, that the law muſt take its courſe, iſſues his warrant to the ſheriffs, directing them to do execution on the day and at the place aſſigned. And in the court of king's bench, if the priſoner be tried at the bar, or brought there by *habeas corpus*, a rule is made for his execution; either ſpecifying the time and place, or leaving it to the diſcretion of the ſheriff. And, throughout the kingdom, by ſtatute 25 Geo. II. c. 37. it is enacted that, in caſe of murder, the judge ſhall in his ſentence direct execution to be performed on the next day but one after ſentence paſſed. But, otherwiſe, the time and place of execution are by law no part of the judgment. It has been well obſerved, that it is of great importance that the puniſhment ſhould follow the crime as early as poſſible; that the proſpect of gratification or advantage, which tempts a man to commit the crime, ſhould inſtantly awake the attendant idea of puniſhment. Delay of execution ſerves only to ſeparate theſe ideas; and then the execution itſelf affects the minds of the ſpectators rather as a terrible ſight, than as the neceſſary conſequence of tranſgreſſion. Execution.

The ſheriff cannot alter the manner of the execution, by ſubſtituting one death for another, without being guilty of felony himſelf. It is held alſo by Sir Edward Coke and Sir Matthew Hale, that even the king cannot change the puniſhment of the law, by altering the hanging or burning into beheading; though, when beheading is part of the ſentence, the king may remit the reſt. And, notwithſtanding ſome examples to the contrary, Sir Edward Coke ſtrongly maintains, that *judicandum eſt legibus, non exemplis.* But others have thought, and more juſtly, that this prerogative, being founded in mercy, and immemorially exerciſed by the crown, is part of the common law. For hitherto, in every inſtance, all theſe exchanges have been for more merciful kinds of death; and how far this may alſo fall within the king's power of granting conditional pardons (viz. by remitting a ſevere kind of death, on condition that the criminal ſubmits to a milder) is a matter that may bear conſideration. It is obſervable, that when Lord Stafford was executed for the popiſh plot in the reign of King Charles II. the then ſheriffs of London, having received the king's writ for beheading him, petitioned the houſe of lords, for a command or order from their lordſhips, how the ſaid judgment ſhould be executed: for, he being proſecuted by impeachment, they entertained a notion (which is ſaid to have been countenanced by Lord Ruſſel), that the king could not pardon any part of the ſentence. The lords reſolved, that the ſcruples of the ſheriffs were unneceſſary; and declared, that the king's writ ought to be obeyed. Diſappointed of raiſing a flame in that aſſembly, they immediately ſignified to the houſe of commons by one of the members, that they were not ſatisfied as to the power of the ſaid writ. That houſe took two days to conſider of it; and then fullenly reſolved, that the houſe was *content* that the ſheriff do execute Lord Stafford by ſevering his head from his body. It is farther related, that when afterwards the ſame Lord Ruſſel was condemned for high treaſon upon indictment, the king, while he remitted the ignominious part of the ſentence, obſerved, "That his lordſhip would now find he was poſſeſſed of that prerogative, which in the caſe of Lord Stafford he had denied him." One can hardly determine (at this diſtance from thoſe turbulent times), which moſt to diſapprove of, the indecent and ſanguinary zeal of the ſubject, or the cool and cruel ſarcaſm of the ſovereign.

To conclude: It is clear, that if, upon judgment to be hanged by the neck till he is dead, the criminal be not thoroughly killed, but revives, the ſheriff muſt hang him again. For the former hanging was no execution of the ſentence; and, if a falſe tenderneſs were to be indulged in ſuch caſes, a multitude of colluſions might enſue. Nay, even while abjurations were in force, ſuch

Execution || Exemplar.

a criminal, ſo reviving, was not allowed to take ſanctuary and abjure the realm; but his fleeing to ſanctuary was held an eſcape in the officer.

EXECUTION, in the law of Scotland. See LAW *Index*.

EXECUTION, in the French muſic, is uſed to denote the manner of ſinging, or of the performance of a ſong. "As to the manner of ſinging, called in France *execution*, no nation may, with any probability diſpute it with the French. If the French, by their commerce with the Italians have gained a bolder compoſition, the Italians have made their advantage of the French, in learning of them a more polite, moving, and exquiſite execution." St Evremond.

EXECUTIVE POWER. The ſupreme executive power of theſe kingdoms is veſted by our laws in a ſingle perſon, the king or queen for the time being. See the article KING.

The executive power, in this ſtate, hath a right to a negative in parliament, i. e. to refuſe aſſent to any acts offered; otherwiſe the two other branches of legiſlative power would, or might, become deſpotic.

EXECUTOR, a perſon nominated by a teſtator, to take care to ſee his will and teſtament executed or performed, and his effects diſpoſed of according to the tenor of the will. See LAW.

EXECUTOR, in *Scots Law*, ſignifies either the perſon entitled to ſucceed to the moveable eſtate of one deceaſed, or who by law or ſpecial appointment is intruſted with the adminiſtration of it.

EXECUTORY, in *Law*, is where an eſtate in fee, that is, made by deed or fine, is to be executed afterwards by entry, livery, or writ. Leaſe for years, annuities, conditions, &c. are termed *inheritances executory*.

EXECUTRY, in *Scots Law*, is the moveable eſtate falling to the executor. Under executry, or moveables, is comprehended every thing that moves itſelf, or can be moved; ſuch as corns, cattle, furniture, ready money, &c.

EXEDRÆ, in antiquity, denoted halls with many ſeats, where the philoſophers, rhetoricians, and men of learning, met for diſcourſe and diſputation. The word occurs in eccleſiaſtical writers as a general name for ſuch buildings as were diſtinct from the main body of the churches, and yet within the limits of the church taken in its largeſt ſenſe. Among the exedræ the chief was the BAPTISTERY.

EXEGESIS, a diſcourſe by way of explanation or comment upon any ſubject. In the Scotch univerſities, there is an exerciſe among the ſtudents in divinity, called an *exegeſis*, in which a queſtion is ſtated by the reſpondent, who is then oppoſed by two or three other ſtudents in their turns; during which time the profeſſor moderates, and ſolves the difficulties which the reſpondent cannot overcome.

EXEGETES, (formed of ἐξηγέομαι, "I explain,") among the Athenians, perſons learned in the laws, whom the judges uſed to conſult in capital cauſes.

EXEGETICA, in *Algebra*, the art of finding, either in numbers or lines, the roots of the equation of a problem, according as the problem is either numerical or geometrical.

EXEMPLAR, a model, or original, to be imitated, or copied. See MODEL.

EXEMPLAR alſo denotes the idea, or image, conceived or formed in the mind of the artiſt, whereby he conducts his work. Such is the idea of Cæſar, which a painter has in his mind when he goes to make a picture of Cæſar.

Exemplification || Exercife.

EXEMPLIFICATION *of Letters Patent*, denotes an examplar, or copy of letters patent, made from the enrolment thereof, and ſealed with the great ſeal of England. Such exemplifications are as effectual to be ſhowed or pleaded, as the letters patent themſelves.

EXEMPTION, in *Law*, a privilege to be free from ſome ſervice or appearance: thus, barons and peers of the realm are, on account of their dignity, exempted from being ſworn upon inqueſts; and knights, clergymen, and others, from appearing at the ſheriff's turn. Perſons of 70 years of age, apothecaries, &c. are alſo by law exempted from ſerving on juries; and juſtices of the peace, attorneys, &c. from pariſh offices.

EXERCISE, among phyſicians, ſuch an agitation of the body as produces ſalutary effects in the animal economy.

Exerciſe may be ſaid to be either active or paſſive. The active is walking, hunting, dancing, playing at bowls, and the like; as alſo ſpeaking, and other labour of the body and mind. The paſſive is riding in a coach, on horſeback, or in any other manner. Exerciſe may be continued to a beginning of wearineſs, and ought to be uſed before dinner in a pure light air; for which reaſon, journeys, and going into the country, contribute greatly to preſerve and re-eſtabliſh health.

Exerciſe increaſes the circulation of the blood, attenuates and divides the fluids, and promotes a regular perſpiration, as well as a due ſecretion of all the humours; for it accelerates the animal ſpirits, and facilitates their diſtribution into all the fibres of the body, ſtrengthens the parts, creates an appetite, and helps digeſtion. Whence it ariſes, that thoſe who accuſtom themſelves to exerciſe are generally very robuſt, and ſeldom ſubject to diſeaſes.

Boerhaave recommends bodily exerciſe in diſeaſes of a weak and lax fibre. By riding on horſeback, ſays his commentator, the pendulous viſcera of the abdomed are ſhaken every moment, and gently rubbed as it were one againſt another, while in the mean time the pure air acts on the lungs with greater force. But it is to be obſerved that a weak man ſhould not ride with a full ſtomach, but either before dinner, or after the digeſtion is nearly finiſhed; for when the ſtomach is diſtended, weak people do not bear theſe concuſſions of the horſe without difficulty; but when the primæ viæ are nearly empty, the remaining feces are diſcharged by this concuſſion. Sailing in a ſhip is alſo an exerciſe of great uſe to weak people. If the veſſel moves with an even motion, by increaſing perſpiration it uſually excites a wonderful alacrity, creates an appetite, and promotes digeſtion. Theſe exerciſes are more eſpecially ſerviceable to weak people; but, in order to ſtrengthen the body by muſcular motion, running and bodily exerciſes are to be uſed. In theſe we ſhould begin with the moſt gentle, ſuch as walking, and increaſe it by degrees till we come to running. Thoſe exerciſes of the body are more eſpecially ſerviceable which give delight to the mind at the ſame time, as tennis, fencing, &c.; for which reaſon, the wiſdom of antiquity appointed rewards for thoſe who excelled in theſe gymnaſtic exerciſes.

Exercise. ercises, that by this means the bodies of their youth might be hardened for warlike toils.

As nothing is more conducive to health than moderate exercise, so violent exercise dissipates the spirits, weakens the body, destroys the elasticity of the fibres, and exhausts the fluid parts of the blood. No wonder, then, that acute and mortal fevers often arise from too violent exercise of the body; for the motion of the venous blood towards the heart being quickened by the contraction of the muscles, and the veins being thus depleted, the arteries more easily propel their contained humours through the smallest extremities into the now less resisting veins; and therefore the velocity of the circulation will be increased through all the vessels. But this cannot be performed without applying the humours oftener, or in a greater quantity, to the secretory organs in the same time, whence the more fluid parts of the blood will be dissipated, and what remains will be inspissated; and by the greater action of the vessels upon their contained fluids, and of the reacting fluids upon the vessels, the blood acquires an inflammatory density. Add to this, that by the violent attrition of the solids and fluids, together with the heat thence arising, all the humours will incline to a greater acrimony, and the salts and oils of the blood will become more acrid and volatile. Hence, says Boerhaave, those fevers which arise from too much exercise or motion, are cured by rest of body and mind, with such aliments and medicines as moisten, dilute, and soften or allay acrimony.

The exercise of a soldier in camp, considered as conducive to health, Dr Pringle distinguishes into three heads: the first relating to his duty, the second to his living more commodiously, and the third to his diversions. The first, consisting chiefly in the exercise of his arms, will be no less the means of preserving health than of making him expert in his duty: and frequent returns of this, early, and before the sun grows hot, will be made more advantageous than repeating it seldom, and staying out long at a time; for a camp affording little convenience for refreshment, all unnecessary fatigue is to be avoided. As to the second article, cutting boughs for shading the tents, making trenches round them for carrying off the water, airing the straw, cleaning their clothes and accoutrements, and assisting in the business of the mess, ought to be no disagreeable exercise to the men for some part of the day. Lastly, As to diversions, the men must be encouraged to them either by the example of their officers, or by small premiums to those who shall excel in any kind of sports as shall be judged most conducive to health: but herein great caution is necessary, not to allow them to fatigue themselves too much, especially in hot weather or sickly times; but above all, that their clothes be kept dry, wet clothes being the most frequent causes of camp diseases.

Exercise, in military affairs, is the ranging a body of soldiers in form of battle, and making them perform the several motions and military evolutions with different management of their arms, in order to make them expert therein. See also Words *of Command*.

Exercise, in the royal navy, is the preparatory practice of managing the artillery and small arms, in order to make the ship's crew perfectly skilled therein, so as to direct its execution successfully in the time of battle. Exercise.

The exercise of the great guns was formerly very complicated, and abounding with superfluities, in our navy, as well as all others. The following method was, it is said, successfully introduced by an officer of distinguished abilities.

1st, Silence.
2d, Cast loose your guns.
3d, Level your guns.
4th, Take out your tompions.
5th, Run out your guns.
6th, Prime.
7th, Point your guns.
8th, Fire.
9th, Sponge your guns.
10th, Load with cartridge.
11th, Shot your guns.
12th, Put in your tompions.
13th, House your guns.
14th, Secure your guns.

Upon beat to arms (every body having immediately repaired to their quarters) the midshipman commanding a number of guns, is to see that they are not without every necessary article, as (at every gun) a sponge, powder horn, with its priming wires, and a sufficient quantity of powder, crow, handspike, bed, quoin, train tackle, &c. sending without delay for a supply of any thing that may be amissing; and for the greater certainty of not overlooking any deficiency, he is to give strict orders to each captain under him, to make the like examination at his respective gun, and to take care that every requisite is in a serviceable condition, which he is to report accordingly. And (besides the other advantages of this regulation) for the still more certain and speedy account being taken upon these occasions, the midshipman is to give each man his charge at quarters (as expressed in the form of the monthly report), who is to search for his particular implements, and, not finding them, is immediately to acquaint his captain, that, upon his report to the midshipman, they may be replaced.

The man who takes care of the powder is to place himself on the opposite side of the deck from that where we engage, except when fighting both sides at once, when he is to be amid ships. He is not to suffer any other man to take a cartridge from him but he who is appointed to serve the gun with that article, either in time of a real engagement or at exercise.

Lanthorns are not to be brought to quarters in the night, until the midshipman gives his orders for so doing to the person he charges with that article. Every thing being in its place, and not the least lumber in the way of the guns, the exercise begins with,

1. "Silence." At this word every one is to observe a silent attention to the officers.

2. "Cast loose your guns." The muzzle lashing is to be taken off from the guns, and (being coiled up in a small compass) is to be made fast to the eye-bolt above the port. The lashing tackles at the same time to be cast loose, and middle of the breeching seized to the thimble of the pomillion. The sponge to be taken down, and, with the crow, handspike, &c. laid upon the deck by the gun. N. B. When prepared for engaging

Exercise. gaging an enemy, the ſeizing within the clinch of the breeching is to be cut, that the gun may come ſufficiently within board for loading, and that the force of the recoil may be more ſpent before it acts upon the breeching.

3. "Level your guns." The breech of your metal is to be raiſed ſo as to admit the foot of the bed's being placed upon the axletree of the carriage, with the quoin upon the bed, both their ends being even one with the other. N. B. When levelled for firing, the bed is to be laſhed to the bolt which ſupports the inner end of it, that it may not be thrown out of its place by the violence of the gun's motion when hot with frequent diſcharges.

4. "Take out your tompions." The tompion is to be taken out of the gun's mouth, and left hanging by its laniard.

5. "Run out your guns." With the tackles hooked to the upper bolts of the carriage, the gun is to be bowſed out as cloſe as poſſible, without the aſſiſtance of crows or handſpikes; taking care at the ſame time to keep the breeching clear of the trucks, by hauling it through the rings; it is then to be bent ſo as to run clear when the gun is fired. When the gun is out, the tacklefalls are to be laid alongſide the carriages in neat fakes, that, when the gun by recoiling overhauls them, they may not be ſubject to get foul, as they would if in a common coil.

6. "Prime." If the cartridge is to be pierced with the priming wire, and the vent filled with powder, the pan alſo is to be filled; and the flat ſpace having a ſcore through it at the end of the pan, is to be covered, and this part of the priming is to be bruiſed with the round part of the horn. The apron is to be laid over, and the horn hung up out of danger from the flaſh of the priming.

7. "Point your guns." At this command the gun is, in the firſt place, to be elevated to the height of the object, by means of the ſide ſights; and then the perſon pointing is to direct his fire by the upper ſight, having a crow on one ſide and a handſpike on the other, to heave the gun by his direction till he catches the object.

N. B. The men who heave the gun for pointing are to ſtand between the ſhip's ſide and their crows or handſpikes, to eſcape the injury they might otherwiſe receive from their being ſtruck againſt them, or ſplintered by a ſhot; and the man who attends the captain with a match is to bring it at the word, "Point your guns," and kneeling upon one knee oppoſite the train-truck of the carriage, and at ſuch a diſtance as to be able to touch the priming, is to turn his head from the gun, and keep blowing gently upon the lighted match to keep it clear from aſhes. And as the miſſing of an enemy in action, by neglect or want of coolneſs, is moſt inexcuſable, it is particularly recommended to have the people thoroughly inſtructed in pointing well, and taught to know the ill conſequences of not taking proper means to hit their mark; wherefore they ſhould be made to elevate their guns to the utmoſt nicety, and then to point with the ſame exactneſs. Having caught the object through the upper ſight, at the word,

8. "Fire," The match is inſtantly to be put to the bruiſed part of the priming; and when the gun is diſcharged, the vent is to be cloſed, in order to ſmother any ſpark of fire that may remain in the chamber of the gun; and the man who ſponges is immediately to place himſelf by the muzzle of the gun in readineſs; when, at the next word, Exercise

9. "Sponge your guns," The ſponge is to be rammed down to the bottom of the chamber, and then twiſted round, to extinguiſh effectually any remains of fire; and, when drawn out, to be ſtruck againſt the outſide of the muzzle, to ſhake off any ſparks or ſcraps of the cartridge that may have come out with it; and next, its end is to be ſhifted ready for loading; and while this is doing, the man appointed to provide a cartridge is to go to the box, and by the time the ſponge is out of the gun, he is to have it ready; and at the word,

10. "Load with cartridge," The cartridge (with the bottom-end firſt, ſeam downwards, and a wad after it) is to be put into the gun, and thruſt a little way within the mouth, when the rammer is to be entered: the cartridge is then to be forcibly rammed down; and the captain at the ſame time is to keep his priming-wire in the vent, and, feeling the cartridge, is to give the word *home*, when the rammer is to be drawn, and not before. While this is doing, the man appointed to provide a ſhot is to provide one (or two, according to the order at that time) ready at the muzzle, with a wad likewiſe; and when the rammer is drawn, at the word,

11. "Shot your guns," The ſhot and wad upon it are to be put into the gun, and thruſt a little way down, when the rammer is to be entered as before. The ſhot and wad are to be rammed down to the cartridge, and there have a couple of forcible ſtrokes; when the rammer is to be drawn, and laid out of the way of the guns and tackles, if the exerciſe or action is continued; but if it is over, the ſponge is to be ſecured in the place it is at all times kept in.

12. "Put in your tompions." The tompions to be put into the muzzle of the cannon.

13. "Houſe your guns." The ſeizing is to be put on again upon the clinched end of the breeching, leaving it no ſlacker than to admit of the gun's being houſed with eaſe. The quoin is to be taken from under the breech of the gun, and the bed, ſtill reſting upon the bolt within the carriage, thruſt under, till the foot of it falls off the axletree, leaving it to reſt upon the end which projects out from the foot. The metal is to be let down upon this. The gun is to be placed exactly ſquare; and the muzzle is to be cloſe to the wood, in its proper place for paſſing the muzzle-laſhings.

14. "Secure your guns." The muzzle-laſhings muſt firſt be made ſecure, and then with one tackle (having all its parts equally taught with the breeching the gun is to be laſhed. The other tackle is to be bowſed taught, and by itſelf made faſt, that it may be ready to caſt off for laſhing a ſecond breeching. N. B. Care muſt be taken to hook the firſt tackle to the upper bolt of the carriage, that it may not otherwiſe obſtruct the reeving of the ſecond breeching, and to give the greater length to the end part of the fall. No pains muſt be ſpared in bowſing the laſhing very taught, that the gun may have the leaſt play that is poſſible, as their being looſe may be productive of very

Exercise, Exercises. dangerous conſequences. The quoin, crow, and hand-ſpike are to be put under the gun, the powder-horn hung up in its place, &c.

Being engaged at any time when there is a large ſwell, a rough ſea or in ſqually weather, &c. as the ſhip may be liable to be ſuddenly much heeled, the port-tackle fall is to be kept clear, and (whenever the working of the gun will admit of it) the man charged with that office is to keep it in his hand; at the ſame time the muzzle-laſhing is to be kept faſt to the ring of the port, and being hauled taught, is to be faſtened to the eye-bolt over the port-hole, ſo as to be out of the gun's way in firing, in order to haul it in at any time of danger.

This precaution is not to be omitted, when engaging to the windward, any more than when to the leeward, thoſe ſituations being very ſubject to alter at too ſhort a warning.

A train tackle is always to be made uſe of with the lee guns: and the man ſtationed to attend it is to be very careful in preventing the guns running out at an improper time.

EXERCISE, may alſo be applied with propriety to the forming our fleets into orders of ſailing, lines of battle, &c. an art which the French have termed *evolutions*, or *tactiques*. In this ſenſe exerciſe may be defined, the execution of the movements which the different orders and diſpoſition of fleets occaſionally require, and which the ſeveral ſhips are directed to perform by means of ſignals. See TACTICS.

EXERCISES, are alſo underſtood of what young gentlemen learn in the academies and riding ſchools, ſuch as fencing, drawing, riding the great horſe, &c.

How uſeful, how agreeable ſoever, ſtudy may be to the mind, it is very far from being equally ſalutary to the body. Every one obſerves, that the Creator has formed an intimate connexion between the body and the mind; a perpetual action and reaction, by which the body inſtantly feels the diſorders of the mind, and the mind thoſe of the body. The delicate ſprings of our frail machines loſe their activity and become enervated, and the veſſels are choked by obſtructions, when we totally deſiſt from exerciſe, and the conſequences neceſſarily affect the brain; a more ſtudious and ſedentary life is therefore equally prejudicial to the body and the mind. The limbs likewiſe become ſtiff; we contract an awkward conſtrained manner; a certain diſguſtful air attends all our actions, and we are very near being as diſagreeable to ourſelves as to others. An inclination to ſtudy is highly commendable; but it ought not, however, to inſpire us with an averſion to ſociety. The natural lot of man is to live among his fellows: and whatever may be the condition of our birth, or our ſituation in life, there are a thouſand occaſions where a man muſt naturally deſire to render himſelf agreeable; to be active and adroit; to dance with a grace; to command the fiery ſteed; to defend himſelf againſt a brutal enemy; to preſerve his life by dexterity; as by leaping, ſwimming, &c. Many rational cauſes have therefore given riſe to the practice of particular exerciſes; and the moſt ſagacious and benevolent legiſlators have inſtituted, in their academies and univerſities, proper methods of enabling youth, who devote themſelves to ſtudy, to become expert alſo in laudable exerciſes.

EXERCITOR, in *Scots Law*, he who employs a ſhip in trade, whether he be owner, or only freights her from the owner. Exercitor || Exeter.

EXERGESIA. See ORATORY, N° 90.

EXERGUM, among antiquarians, a little ſpace aronnd or without the figures of a medal, left for the inſcription, cipher, device, date, &c.

EXETER, the capital city of Devonſhire, ſituated on the river Ex, ten miles north of the Britiſh channel: W. Long. 3. 40. N. Lat. 50. 44. Anciently the name of this city was *Iſex*, and *Iſia Dumnoniorum*. The preſent name is a contraction of *Exceſter*, that is, a city upon the Ex. It is large, populous, and wealthy, with gates, walls, and ſuburbs: the circumference of the whole is about three miles. It is the ſee of a biſhop, transferred hither from Crediton, by Edward the Confeſſor; and is one of the principal cities in the kingdom, for its buildings, wealth, and number of its inhabitants. It had ſix gates, beſides many turrets, ſeveral of which are now pulled down. It had formerly ſo many convents, that it was called *Monktown*, till King Athelſtan changed its name to Exeter, about the year 940; at which time he alſo fortified the city (which had before been only encloſed with a ditch and a fence of timber) with circular walls, embattlements, towers, and turrets of ſquared-ſtone, encircling the whole, except the weſtern ſide, with a deep moat. Beſides chapels and five large meeting houſes, there are now 15 churches within the walls, and four without. St Peter's, the cathedral, is a magnificent pile; though little now remains of the ancient fabric of the church, except that part which is called *Our Lady's Chapel*. It has a ring of 12 bells, reckoned the largeſt ring of the largeſt bells in England; as is alſo its organ, whoſe largeſt pipes are 15 inches in diameter. In 1763 the cathedral was repaired, beautified, and new paved; when, in removing the old pavement, was found the leaden coffin of Biſhop Bitton, who died in 1307; the top of which, being decayed, afforded an opportunity of viewing the ſkeleton lying in its proper form: near the bones of the finger was found a ſapphire ring ſet in gold; the ſtone conſiderably large, but of no great value, on account of ſeveral flaws in it. Near this ſtood a ſmall neat chalice and patten of ſilver gilt, but the damp had deſtroyed the greateſt part of the gilding. In the centre of the patten was engraved a hand, with the two forefingers extended in the attitude of benediction. The top of the crozier was alſo found, but totally decayed. A moſt beautiful modern painted glaſs window has been lately erected at the weſtern end of the cathedral, the eaſtern end having before a remarkable fine antique one. In the other windows there is much fine ancient painted glaſs. The altar is remarkable for its beautiful deſign and execution. On the left hand ſide of it there yet exiſts the ſeat where Edward the Confeſſor and his queen ſat and inſtalled Leofricus, his chancellor, the firſt biſhop of Exeter; and in the fourth croſs aiſle is the monument of the ſame Leofricus, who died 1073, which at the time of his interment was a part of the churchyard, but by the enlarging of the church by his ſucceſſors, became nearly the middle of the building. The grand weſtern end of the church is moſt magnificently adorned with the ſtatues of the patriarchs, &c. The chapter houſe was built in 1439.

The

Exeter. The beautiful throne for the biſhop was conſtructed about 1466, and is ſaid to be the grandeſt of the kind in Britain. The great north tower was completed in 1485, which contains a bell, that weighs 12,500 pounds; and exceeds the great Tom of Lincoln by 2500 pounds. This city has had divers charters granted, or confirmed by moſt of our kings; but it was made a mayor town in the reign of King John, and a county of itſelf by King Henry VIII. It is governed by a mayor, 24 aldermen, four bailiffs, a recorder, chamberlain, ſheriff, town-clerk, &c. They have a ſword-bearer, and four ſtewards, four ſerjeants at mace wearing gowns, and ſtaff-bearers in liveries with ſilver badges. It had anciently a mint; and in the reigns of King William III. and Queen Anne, many pieces of ſilver money were coined here, which have the letter E under the buſt. Here are 12 or 13 incorporate city companies. All pleas and civil cauſes are tried by the mayor, recorder, aldermen, and common council; but criminal cauſes, and thoſe relating to the peace, are determined by eight aldermen, who are juſtices of the peace. Here are four principal ſtreets, all entering in the middle of the city, which is therefore called *Carfox*, from the old Norman word *Quatre voix*, i. e. the four ways. Near it is a conduit, lately removed from the centre to the ſide of the principal ſtreet, which was firſt erected by William Duke, mayor of the city, in the reign of Edward IV. and there are others well ſupplied with water brought in pipes from the neighbourhood. There is an old caſtle in the north-eaſt part of the city, called *Rougemont*, from the red ſoil it ſtands on; from thence there is a pleaſant proſpect from the walls. It is ſuppoſed to have been built by the Weſt Saxon kings, and that they reſided here, as did afterwards the earls and dukes of Cornwall. This caſtle was remarkably ſtrong both by nature and art. The gate which originally led into it, was walled up by order of William the Conqueror, in token of his having reduced it to his obedience after a very obſtinate reſiſtance; and cloſe by it an inferior gate was made in the wall in which ſtate they both remain. The outward ſtone facing is kept in tolerable repair; but the inſide being but earth, is gradually crumbled down. Here yet remains the ancient chapel, built in 1260, and kept in good repair, where prayers are read, and a ſermon preached in ſeſſions weeks. The city itſelf is healthy, and pleaſantly ſituated on the ſides of a hill, having other hills to its N. W and S. by which it is ſheltered from the force of ſtorms. The bank which ſuſtained the ditch that in a great part ſurrounded the caſtle, is planted and gravelled, and accommodated with ſeats, it being the place of reſort for walking for the inhabitants; and the ditch between it and the caſtle being filled up, is now thickly planted with elms, which form a delightful grove. The old palace is now entirely demoliſhed, and an elegant ſeſſions houſe erected, where the aſſizes, quarter-ſeſſions, and county courts are held. In the city and ſuburbs are priſons both for debtors and malefactors; a workhouſe, alms houſes, and charity ſchools; an hoſpital for the ſick and lame poor of the city and county, upon the model of the infirmaries of London and Weſtminſter; and two free grammar-ſchools. It has markets on Wednеſdays and Fridays; and four fairs in the year. Great trade is carried on here in ſerges, perpetuanas, long ells, and other woollen goods, in which it is computed that at leaſt 600,000l. a year is traded for; yet no markets were erected here for wool, yarn, and kerſeys, till the 30th of Henry VIII. Before that time the merchants drove a conſiderable trade to Spain and France: they were incorporated in the reign of Queen Mary I. by the name of "The Governor, Conſuls, and Society of Merchant-adventurers, trading to France." Here is alſo a weekly ſerge market, the greateſt in England, next to the Brigg market at Leeds in Yorkſhire. It is ſaid that ſome weeks as many ſerges have been ſold here as amount to 80,000l. or 100,000l.; for beſides the vaſt quantities of their woollen goods ſhipped for Portugal, Spain, and Italy, the Dutch give large commiſſions for buying up ſerges, perpetuanas, &c. for Holland and Germany. It is particularly remarked of this city, that it is almoſt as full of gentry as of tradeſmen; and that more of its mayors, and bailiffs have deſcended from, or given riſe to good families, than in any other city of its bigneſs in the kingdom: for the great trade and flouriſhing ſtate of this city tempted gentlemen to ſettle their ſons in it, contrary to the practice of many of the inland as well as northern counties, where, according to the vain and ruinous notion of the Normans, trade was deſpiſed by the gentry, as fit for only mechanics and the vulgar. This city was under the juriſdiction of the Romans, whoſe coins have been frequently dug up in and about it. After they left England, the Saxons drove the Britons out of it into Cornwall, and encompaſſed it with a ditch, beſides bulwarks. The Danes attacked and ſpoiled it in 875; and afterwards in revenge of the general maſſacre of the Danes by the Engliſh, Sweyn one of their kings, came hither with a great force, put the men to the ſword, raviſhed the women, maſſacred the children, burnt the city, and defaced the walls. A long time after this, juſt as it was reviving, William the Conqueror beſieged and took it; and it was again beſieged in the reigns of King Stephen and Edward IV. In the reign of Henry VII. it was again beſieged by Perkin Warbeck, and battered furiouſly: but the citizens forced him to raiſe the ſiege; which ſo pleaſed the king, that he came hither, and preſented a cap of maintenance to the city, and gave the very ſword from his ſide to be borne always before the mayor. In the reign of Edward VI. in July 1544, it was ſmartly cannonaded by the rebels of Cornwall and Devon, who almoſt ſtarved it by breaking down its bridges, cutting off its water, and ſtopping up all paſſages; but it held out till the lord John Ruſſel came with a force and raiſed the ſiege on the 6th of Auguſt, which was then appointed as an anniverſary day of thankſgiving by the city, and is ſtill obſerved as ſuch. King Charles I.'s queen, to whom this city gave ſhelter in the civil wars, was here delivered of Henrietta, afterwards ducheſs of Orleans; whoſe picture is in its guildhall, as are alſo General Monk's and George I.'s, &c. In the ſouth-eaſt quarter of the city was a houſe called *Bedford houſe*, wherein the above queen was delivered of the princeſs. This having lately been taken down, an elegant circus is built on the ſpot, with a theatre adjoining it; and for the conveniency of the inhabitants, a paſſage has been made through the town wall to Southern Hay, on which green ſtands the county hoſpital already ſpoken of, beſides a conſiderable number of new buildings. There

Exeter || Exhauſtions

are remains of ſeveral ancient ſtructures, which are daily giving way to modern erections; among the reſt, an old building, ſaid to have been a palace of King Athelſtan. The guildhall is a ſpacious and convenient building, whoſe front or portico projects a great way into the ſtreet, and was firſt erected in 1330, to which its preſent front was rebuilt in 1593, and repaired in 1720. An arm of the ſea formerly flowed nearly up to the city's wall, till 1316, when Hugh Courtenay earl of Devon, in revenge for an affront, ruined the navigation, by conſtructing wears and dams in the river; but to remedy it, in 1539, an act of parliament paſſed for making a navigable canal, for the better conveyance of goods in barges to and from the city to Topſham. This was carried into execution in 1581, but not completed till 1675; nor was it after all found ſufficient, till the preſent haven was conſtructed in 1697, when it was rendered capable of bringing ſhips of 150 tons quite to the quay, conſtructed near the walls of the city. In ſhort, Exeter, by a conſtant adherence to its motto, *Semper fidelis*, has been applauded by all hiſtorians for its inviolable fidelity to its ſovereigns, whether they held their crown by hereditary or parliamentary right. The city ſends two members to parliament; and gives title of earl to the Cecils.—The ſee of Exeter was once one of the moſt wealthy in the kingdom; but its revenues were moſt ſhamefully waſted by Biſhop Voyſey, who alienated its lands. What little he left was ſo much encumbered, that the ſee has never been able to recover its former grandeur; and ſo ſmall are its preſent revenues, that it has been found neceſſary for the biſhop to hold ſome other preferment for the better ſupport of his dignity and rank. This ſee hath yielded to the nation three lord chancellors, two lord treaſurers, one lord preſident of Wales, and one chancellor to the univerſity of Oxford. The dioceſe contains the entire counties of Devonſhire and Cornwall, wherein are 604 pariſhes, whereof 239 are impropriate. It hath four archdeacons, viz. of Cornwall, Exeter, Barnſtable, and Totneſs. The dioceſe was formerly valued in the king's books at 1556l. 14s. 6d.; but, ſince Biſhop Voyſey's time, it is lowered to 500l. and is computed to be worth annually 2700l. The clergy's tenth is 1200l. 15s. 2¼d. To the cathedral belong a biſhop, a dean, four archdeacons, a chancellor, a treaſurer, a chantor, 24 prebendaries, and other inferior officers and ſervants.

EXFOLIATION, a term uſed by ſurgeons for the ſcaling of a bone, or its riſing and ſeparating into thin laminæ or ſcales.

EXHALATION, a general term for all effluvia or ſteams raiſed from the ſurface of the earth in form of vapour.

EXHAUSTIONS, in *Mathematics*. Method of exhauſtions, is a way of proving the equality of two magnitudes, by a *reductio ad abſurdum*; ſhowing, that if one be ſuppoſed either greater or leſs than the other, there will ariſe a contradiction.

The method of exhauſtions was of frequent uſe among the ancient mathematicians; as Euclid, Archimedes, &c. It is founded on what Euclid ſays in his tenth book; viz. that thoſe quantities whoſe difference is leſs than any aſſignable quantity, are equal; for if they were unequal, be the difference never ſo ſmall, yet it may be ſo multiplied, as to become greater than either of them; if not ſo, then it is really nothing. This he aſſumes in the proof of Prob. I. book x. which imports, that if, from the greater of two quantities, you take more than its half, and from the remainder more than its half, and ſo continually, there will, at length, remain a quantity leſs than either of thoſe propoſed. On this foundation it is demonſtrated, that if a regular polygon of infinite ſides be inſcribed in, or circumſcribed about, a circle; the ſpace, which is the difference between the circle and the polygon, will, by degrees, be quite exhauſted, and the circle become equal to the polygon.

Exheredation || Exigenters.

EXHEREDATION, in the civil law, with us ordinarily called *diſinheriting*, is the father's excluding his ſons from inheriting his eſtate.

There are 14 cauſes of exheredation expreſſed in Juſtinian's Novellæ; without ſome one of which cauſes, he decrees the exheredation null, and the teſtament inofficious, as the civilians call it. Indeed, by the ancient Roman law, the father might pronounce exheredation without any cauſe; but the rigour of this law was reſtrained and moderated by Juſtinian.

EXHIBIT, in *Law*, is where a deed, or other writing, being produced in a chancery ſuit to be proved by witneſſes, the examiner, or commiſſioner appointed for the examination of any ſuch, certifies on the back of the deed or writing, that the ſame was ſhown to the witneſs at the time of his examination, and by him ſworn to.

EXHIBITION, in *Law*, a producing, or ſhowing, of titles, authorities, and other proofs, of a matter in conteſt.

Anciently they uſed the phraſe, *exhibition* of a tragedy, comedy, or the like; but now we ſay *repreſentation* in lieu thereof.

EXHIBITION, in our old writers, is uſed for an allowance of meat and drink, ſuch as was cuſtomary among the religious appropriators of churches, who uſually made it to the depending vicar. The benefactions ſettled for the maintaining of ſcholars in the univerſities, not depending on the foundation, are alſo called *exhibitions*.

EXHORTATION, in *Rhetoric*, differs only from *ſuaſion*, in that the latter principally endeavours to convince the underſtanding, and the former to work on the affections.

EXHUMATION, (of *ex* "out of," and *humus* "ground"), the act of digging up a body interred in holy ground, by the authority of the judge. In France, the exhumation of a dead body is ordered, upon proof that he was killed in a duel. By the French laws, a parſon has a right to demand the exhumation of the body of one of his pariſhioners, when interred out of the pariſh without his conſent.

EXIGENCE, or EXIGENCY, that which a thing requires, or which is expedient and ſuitable thereto.

EXIGENT, in *Law*, a writ which lies where the defendant in a perſonal action cannot be found, nor any effects of his within the county, by which he may be attached or diſtrained.

EXIGENTERS, four officers in the court of common pleas, who make all exigents and proclamations, in all actions where proceſs of outlawry lies. Writs of ſuperſedeas, as well as the prothonotaries, upon exigents, are likewiſe drawn up in their office.

EXILE.

Exile ‖ Exorcism.

EXILE. See BANISHMENT.

Among the Romans, the word *exilium* properly signified an interdiction or exclusion from water and fire; the necessary consequence of which was, that the interdicted person must betake himself into some other country, since there was no living without fire and water.—Thus Cicero, *ad Herenn.* observes, that the form of the sentence did not express *exilium*, but only *aquæ et ignis interdictio*. The same author remarks, that exile was not properly a punishment, but a voluntarily flying or avoiding the punishment decreed: *Exilium non esse supplicium, sed perfugium, portusque supplicii.* He adds, that there was no crime among the Romans, as among other nations, punished with exile; but exile was a resource to which people flew voluntarily, in order to avoid chains, ignominy, starving, &c.

The Athenians frequently sent their generals and great men into exile, out of envy of their merits, or distrust of their too great authority. See OSTRACISM.

EXISTENCE, that whereby any thing has an actual essence, or is said to *be*. See the article METAPHYSICS.

EXIT, properly expresses the departure of a player from off the stage, when he has acted his part. The word is also used in a figurative sense, to express any kind of departure, even death.

EXITERIA, in antiquity, oblations or prayers to any of the gods for a prosperous expedition or journey. There were also feasts under this denomination, which were celebrated by the Greeks with sacrifices and prayers, when their generals undertook expeditions against an enemy.

EXOCOETUS, the FLYING FISH, a genus of fishes belonging to the order of abdominales. See ICHTHYOLOGY *Index*.

EXODIARY, in the ancient Roman tragedy, was the person who, after the drama or play was ended, sung the EXODIUM.

EXODIUM, in the ancient Greek drama, one of the four parts or divisions of tragedy, being so much of the piece as included the catastrophe and unravelling of the plot, and answering nearly to our fourth and fifth acts.

EXODIUM, among the Romans, consisted of certain humorous verses rehearsed by the exodiary at the end of the Fabulæ Atellanæ.

EXODIUM, in the Septuagint, signifies the end or conclusion of a feast. Particularly it is used for the eighth day of the feast of tabernacles, which, it is said, had a special view to the commemoration of the *exodus* or departure out of Egypt.

EXODUS, a canonical book of the Old Testament; being the second of the Pentateuch, or five books of Moses.

It is so called from the Greek ἔξοδος, the "going out" or departure of the children of Israel from the land of Egypt; the history of which is delivered in this book, together with the many miracles wrought on that occasion.

EXOMPHALUS, in *Surgery*, called also *omphalocele*, and *hernia umbilicalis*, is a preternatural tumor of the abdomen, at the navel, from a rupture or distension of the parts which invest that cavity.

EXORCISM, the expelling of devils from persons possessed, by means of conjurations and prayers. The Jews made great pretences to this power. Josephus tells several wonderful tales of the great success of several exorcists. One Eleazer, a Jew, cured many dæmoniacs, he says, by means of a root set in a ring. This root, with the ring, was held under the patient's nose, and the devil was forthwith evacuated. The most part of conjurors of this class were impostors, each pretending to a secret nostrum or charm which was an overmatch for the devil. Our Saviour communicated to his disciples a real power over dæmons, or perhaps over the diseases said to be occasioned by dæmons. See DÆMONIAC. Exorcism ‖ Exoteric.

Exorcism makes a considerable part of the superstition of the church of Rome, the rituals of which forbid the exorcising any person without the bishop's leave. The ceremony is performed at the lower end of the church, towards the door. The exorcist first signs the possessed person with the sign of the cross, makes him kneel, and sprinkles him with holy water. Then follow the litanies, psalms, and prayer; after which the exorcist asks the devil his name, and adjures him by the mysteries of the Christian religion not to afflict the person any more: then, laying his right hand on the dæmoniac's head, he repeats the form of exorcism, which is this: "I exorcise thee, unclean spirit, in the name of Jesus Christ: tremble, O Satan! thou enemy of the faith, thou foe of mankind, who hast brought death into the world; who hast deprived men of life, and hast rebelled against justice: thou seducer of mankind, thou root of evil, thou source of avarice, discord, and envy." The Romanists likewise exorcise houses and other places, supposed to be haunted by unclean spirits; and the ceremony is much the same with that for persons possessed.

EXORCISTS, in church history, an order of men, in the ancient church, whose employment it was to exorcise or cast out devils. See the preceding article.

EXORDIUM, in *Oratory*, is the preamble or beginning, serving to prepare the audience for the rest of the discourse.

Exordiums are of two kinds; either just and formal, or vehement and abrupt. The last are more suitable on occasions of extraordinary joy, indignation, or the like. See ORATORY, N° 26.

EXOSTOSIS (from ἐξ *out*, and ὀστέον, *a bone*), in *Anatomy*, an acute eminence or excrescence, pushing preternaturally above the bone.

EXOTERIC and ESOTERIC, are terms denoting *external* and *internal*, and applied to the double doctrine of the ancient philosophers: the one was public or *exoteric;* the other secret, or *esoteric*. The first was that which they openly professed and taught to the world; the latter was confined to a small number of chosen disciples. This method was derived originally from the Egyptians; who, according to the united testimony of Herodotus, Diodorus Siculus, Strabo, Plutarch, &c. had a twofold philosophy, one secret and sacred, another public and common. The same practice also obtained among the Persian Magi, the Druids of the Gauls, and the Brachmans of India. The Egyptian priests, with whom it originated, sustained the character of judges and magistrates, and probably introduced this distinction with a view to the public welfare, and to serve the purposes of legislation and government. Clement of Alexandria informs us, that

Exotic || Expectation.

that they communicated their myſteries principally to thoſe who were concerned in the adminiſtration of the ſtate; and Plutarch confirms the ſame declaration. However, others have ſuppoſed that they invented the fables of their gods and heroes, and the other external ceremonies of their religion, to diſguiſe and conceal natural and moral truths; but whatever was the motive of their practice, it was certainly applied to political purpoſes.

EXOTIC, a term properly ſignifying *foreign* or *extraneous*, i. e. brought from a remote or ſtrange country. In which ſenſe we ſometimes ſay *exotic* or *barbarous terms* or *words*, &c. The word is derived from the Greek ἐξω, ἐξωεν, *extra*, "without, on the outſide."

EXOTIC, is chiefly applied to plants which are natives of foreign countries, particularly thoſe brought from the Eaſt and Weſt Indies, and which do not naturally grow in Europe.

The generality of exotics, or exotic plants, do not thrive in England without ſome peculiar care and culture: they require the warmth of their own climates; whence the uſe of hot beds, glaſs frames, green houſes, &c. See GARDENING *Index*.

EXPANSION, among metaphyſicians, denotes the idea we have of laſting diſtance, all whoſe parts exiſt together.

EXPANSION, in *Phyſics*, the enlargement or increaſe of bulk in bodies, chiefly by means of heat. This is one of the moſt general effects of that ſubtile principle, being common to all bodies whatever, whether ſolid or fluid. In ſome few caſes, indeed, bodies ſeem to expand as they grow cold, as water in the act of freezing: but this is found to be owing to a new arrangement of the particles, or to cryſtallization; and is not at all a regular and gradual expanſion like that of metals, or any other ſolid or fluid ſubſtance by means of heat. In certain metals alſo, an expanſion takes place when they paſs from a fluid to a ſolid ſtate: but this too is not to be accounted any proper effect of cold, but of the arrangement of the parts of the metal in a peculiar manner; and is therefore to be aſcribed to a kind of cryſtallization.

The expanſion of bodies by heat is very various, and in ſolids does not ſeem to be guided by any certain rule. In the 48th volume of the Phil. Tranſ. Mr Smeaton has given a table of the expanſions of many different ſubſtances. See CHEMISTRY *Index*.

EXPECTANCY, ESTATES IN, are of two ſorts; one created by act of the parties, called a *remainder*; the other, by act of law, called *reverſion*.

EXPECTATION, in the doctrine of chances, is applied to any contingent event, and is capable of being reduced to the rules of computation. Thus a ſum of money in expectation when a particular event happens, has a determinate value before that event happens; ſo that if a perſon is to receive any ſum, e. gr. 10l. when an event takes place which has an equal probability of happening and failing, the value of the expectation is half that ſum or 5l.; and in all caſes the expectation of obtaining any ſum is eſtimated by multiplying the value of the ſum expected by the fraction which repreſents the probability of obtaining it. The expectation of a perſon who has three chances in five of obtaining 100l. is equal to $\frac{3}{5} \times 100$ or 60l. and the probability of obtaining 100l. in this caſe is equal to $\frac{60}{100} = \frac{3}{5}$. Expectation || Experience

EXPECTATION of Life, ſignifies, in the doctrine of life annuities, that ſhare or number of the years of human life, which a perſon of any given age may expect to enjoy on an equality of chance.

According to Mr Simpſon, by the expectation of life we are not to underſtand that period which a perſon may have an equal chance of ſurviving, which is a different and more ſimple conſideration; but the number of years at which the purchaſe of an annuity ought to be valued, granted on it without diſcount of money. There will be a greater or leſs difference in this number of years, in proportion to the various degrees of mortality to which the different ſtages of human life are expoſed. Thus, it is more than an equal chance that an infant juſt come into the world, will not reach the age of 10 years; yet the expectation of life, or ſhare of exiſtence due to it, is almoſt 20 years upon an average. The reaſon of this vaſt difference is the exceſs of the probability of death in the firſt tender years of exiſtence above that which reſpects the more advanced ſtages. If the numbers of thoſe who die at every aſſignable period were always found to be on an equality, the two quantities already mentioned would be the ſame; but when theſe numbers conſtantly become leſs and leſs, the expectation muſt of conſequence become the greater of the two.

EXPECTORANTS, in *Pharmacy*, medicines which promote EXPECTORATION. See MATERIA MEDICA *Iedex*.

EXPECTORATION, the act of evacuating or bringing up phlegm or other matters out of the trachea, lungs, &c. by coughing, hauking, ſpitting, &c.

EXPEDITATION, in the foreſt laws, ſignifies a cutting out the balls of a dog's fore feet for the preſervation of the king's game.

Every one that keeps any great dog not expeditated forfeits three ſhillings and fourpence to the king. In maſtiffs, not the ball of the feet, but the three claws, are to be cut to the ſkin. Inſtit. Part VI. p. 308.

This expeditation was to be performed once in every three years, and was done to every man's dog who lived near the foreſt, and even the dogs of the foreſters themſelves.

EXPEDITION, the march of an army to ſome diſtant place, with a view of hoſtilities. Such were the expeditions of Cyrus againſt Artaxerxes, and of Bacchus and Alexander into the Indies.

Expeditions for the recovery of the Holy Land were called *croiſades*.

EXPERIENCE, a kind of knowledge acquired by long uſe without any teacher. It conſiſts in the ideas of things we have ſeen or read, which the judgement has reflected on, to form for itſelf a rule or method.

Authors make three kinds of experience: The firſt is the ſimple uſes of the external ſenſes, whereby we perceive the phenomena of natural things without any direct attention thereto, or making any application thereof. The ſecond is, when we premeditately and deſignedly make trials of various things, or obſerve thoſe done by others, attending cloſely to all effects and circumſtances. The third is that preceded by a foreknowledge, or at leaſt an apprehenſion of the event, and

and determines whether the apprehenſion were true or alſe; which two latter kinds, eſpecially the third, are of great ſervice in philoſophy.

EXPERIMENT, in *Philoſophy*, is the trial of the reſult or effect of the applications and motions of certain natural bodies, in order to diſcover ſomething of their motions and relations, by which ſome of their phenomena or cauſes may be aſcertained.

EXPERIMENTAL PHILOSOPHY,

IS that which has its foundation in experience, wherein nothing is aſſumed as a truth but what is founded upon ocular demonſtration, or which cannot be denied without violating the common ſenſe and perceptions of all mankind.

In former times philoſophers, when reaſoning about natural things, inſtead of following this method, aſſumed ſuch principles as they imagined ſufficient for explaining the phenomena, without conſidering whether theſe principles were juſt or not. Hence for a great number of ages no progreſs was made in ſcience; but ſyſtems were heaped upon ſyſtems, having neither conſiſtency with one another nor with themſelves. No proper explanations indeed were given of any thing; for all theſe ſyſtems, when narrowly examined, were found to conſiſt merely in changes of words, which were often very abſurd and barbarous. The firſt who deviated from this method of philoſophizing, if we may call it by that name, was Friar Bacon, who lived in the 13th century, and who ſpent 2000l. (an immenſe ſum in thoſe days) in making experiments. The Admirable Crichton, who flouriſhed about the year 1580, not only diſputed againſt the philoſophy of Ariſtotle, which had for ſo long been in vogue, but wrote a book againſt it. Cotemporary with this celebrated perſonage was Francis Bacon lord chancellor of England, who is looked upon to be the founder of the preſent mode of philoſophizing by experiments. But though others might lay the foundation, Sir Iſaac Newton is juſtly allowed to have brought this kind of philoſophy to perfection; and to him we are certainly indebted for the greateſt part of it. Unfortunately, however, neither Lord Bacon nor Sir Iſaac Newton had an opportunity of knowing many important facts relating to the principles of fire and electricity, which have ſince been brought to light. Hence all their philoſophy was merely mechanical, or derived from the viſible operations of ſolid bodies, or of the groſſer fluids, upon one another. In ſuch caſes, therefore, where the more ſubtile and active fluids were concerned, they fell into miſtakes, or were obliged to deny the exiſtence of the principles altogether, and to make uſe of terms which were equally unintelligible and incapable of conveying any information with thoſe of their predeceſſors. A remarkable inſtance of the errors into which they were thus betrayed, we have in the doctrine of projectiles, where the moſt enormous deviations from truth were ſanctified by the greateſt names of the laſt century, merely by reaſoning from the reſiſtance of the air to bodies moving ſlowly and viſibly, to its reſiſtance to the ſame bodies when moved with high degrees of velocity †. In other caſes they were reduced to make uſe of words to expreſs immechanical powers, as attraction, repulſion, rarefaction, &c. which have ſince tended in no ſmall degree to embarraſs and confound ſcience by the diſputes that have taken place concerning them. The foundations of the preſent ſyſtem of experimental philoſophy are as follows:—

† See *Gunnery*.

I. All the material ſubſtances of which the univerſe is compoſed are called *natural bodies*. What we perceive uniform and invariable in theſe ſubſtances we call their *properties*. Some of theſe are general and common to all matter, as extenſion; others are proper to particular ſubſtances, for inſtance fluidity; while ſome appear to be compounded of general and particular properties, and thus belong to a ſtill ſmaller number; as the properties of air, which are derived from the general property of extenſion combined with thoſe of fluidity, elaſticity, &c.

II. In taking a particular review of the properties of bodies we naturally begin with that of *extenſion*. This manifeſts itſelf by the three dimenſions of length, breadth, and thickneſs. Hence proceeds the diviſibility of matter; which the preſent ſyſtem ſuppoſes to reach even to infinity: but though this propoſition be ſupported by mathematical demonſtrations, it is impoſſible we can either have any diſtinct idea of it, or of the oppoſite doctrine, which teaches that matter is compoſed of exceſſively minute particles called *atoms*, which cannot be divided into ſmaller ones. The ſubtility indeed to which ſolid bodies may be reduced by mechanical means is very ſurpriſing; and in ſome caſes is ſo great, that we might be tempted to ſuppoſe that a farther diviſion is impoſſible. Thus, in grinding a ſpeculum, the inequalities of its ſurface are ſo effectually worn off, that the whole becomes in a certain degree inviſible, ſhowing not itſelf by the light which falls upon it, but the image of other bodies; but the ſmalleſt ſcratch which diſturbs the equality of the ſurface is at once diſtinctly viſible.

III. From the arrangement of theſe ultimate particles of matter, whatever we ſuppoſe them to be, ariſe the various figures of bodies: and hence figure is a property of all bodies no leſs univerſal than extenſion, unleſs we chooſe to ſpeak of the ultimate particles of matter, which, as they are ſuppoſed to be deſtitute of parts, muſt conſequently be equally deſtitute of figure; and the ſame conſequence will follow whether we adopt this ſuppoſition or the other. The figures of bodies are ſo extremely various and diſſimilar, that it is impoſſible to find any two perfectly alike. It is indeed the next thing to impoſſible to find two in which the diſſimilarity may not be perceived by the naked eye; but if any ſuch ſhould be found, the microſcope will quickly diſcover the imbecility of our ſenſes in this reſpect. Solidity is another property eſſential to all matter. By this we mean that property which one quantity of matter has of excluding any other from the ſpace which itſelf occupies

occupies at that time. Hence arifes what we call *refiftance*, which is always an indication of folidity; and no lefs fo in thofe bodies which we call *fluid* than in thofe which are the moft folid. This may at firft feem to be a contradiction; but fluids yield only when they can get away from the preffure; in all other cafes they refift as violently as the moft folid bodies. Thus water confined in a tube will as effectually refift the impreffion of a piflon thruft down upon it as though it were the moft folid fubftance. Air indeed will yield for a certain time; but this, as appears from feveral experiments, is entirely owing to a more fubtile fluid, viz. that of elementary fire, being preffed out from among its particles. As long as this fluid can be forced out, either from among the particles of air, water, or any other more grois fluid fubftance, the latter will be found compreffible, as a heap of wet fand would be by fqueezing the water out from it; but when we come to the moft fubtile of all elements, fuch as we fuppofe that of fire to be, there cannot be any poffibility of compreffing it, even though we had a veffel fo clofe as to prevent it from efcaping through its fides; becaufe its parts are already as near each other as they can be.

IV. The diftance of the parts of bodies from each other is what we call their porofity, and was formerly fuppofed to be owing to a vacuum interfperfed between them; but now it is generally allowed that the pores of folid bodies as well as of fluids are filled with an extremely fubtile matter which pervades all nature. The porofity of bodies with regard to one another may be thus explained. Wood or a fponge is porous with regard to water: but water itfelf is porous with regard to air, which it abforbs in confiderable quantity. But air and water are porous with regard to the element of fire, which produces very confiderable changes upon them, according to the quantity of it they contain, or the manner it acts in their pores. This element itfelf, however, is not porous with regard to any other fubftance. Its pores, therefore, if it has any, muft be abfolute vacuities, deftitute of any matter whatever. Vacuities of this kind indeed are fuppofed to be abfolutely neceffary to motion: for though we may fay, matter being divifible almoft *ad infinitum*, that a body or fubftance more folid may move in another fubftance that is more fubtile, and that will give way to its motion, we muft nevertheleis have recourfe to a laft refort, and admit of an ultimate vacuum, which will give room fufficient to the leaft corpufcle, that its part *A* may take the place of its part *B* without the leaft refiftance: befides, it is not to be imagined, that nature, in fact, admits of that infinite divifibility which our imagination can conceive, and that every thing which is poffible in idea, is at all times practicable. All that exifts is poffible, but all that is poffible does not however exift. By denfity, is underftood the proportion between the extenfion and folidity of a body; one body therefore is more denfe than another, when, under the fame degree of extenfion, it contains more folid matter: and this quality arifes from condenfation and compreffion. Elafticity is nothing more than that effort by which certain bodies, when compreffed, endeavour to reftore themfelves to their former ftate; and this property fuppofes them compreffible. As all thefe natural properties of bodies are of great utility in explaining the principles of phyfics and in applying them to all the arts, experimental philofophy proves their reality by a thoufand examples.

V. We difcover ftill other properties in bodies; fuch as mobility, which we muft not here confound with motion. This mobility arifes from certain difpofitions which are not in an equal degree in all bodies: from whence it comes that fome are more eafily moved than others: and this proceeds from the refiftance to motion which is perceived in all bodies, having regard merely to their maffes; and this refiftance is called *vis inertiæ*, or *inert force*. A body is faid to be in motion when it is actually moving from one place to another: or, whenever a body changes its fituation with regard to the objects that furround it, either nearly or remotely, it is faid to be in motion. There are three principal matters to be conlidered in a moving body; its direction, its velocity, and the quantity of its motion: and here phyfics explains the force or moving power; it likewife diftinguifhes between fimple and compound motion. Simple motion is that which arifes from only one force, or which tends to one point only. It defcribes the laws, and explains the refiftance, of mediums; the refiftance of friction; the difficulties of a perpetual motion; the alteration of direction occafioned by the oppofition of a fluid matter; reflected or reverberated motion; the communication of motion by the fhock of bodies, &c. Compound motion is that of a body impelled to move by feveral caufes or powers which act according to their different directions. Phyfics here likewife inveftigates the laws of motion; and is particularly applied to the explaining, under this head, what are called the *central forces*, which produce a motion that is either circular or in a curve line, and which inceffantly urge the moving body either to approach or recede from the centre. To diftinguifh thefe from each other, the former is called the *centripetal force*, and the latter the *centrifugal force*. See DYNAMICS.

VI. By gravity, or ponderofity, is to be underftood that force which occafions bodies to pafs from a higher to a lower place, when nothing oppofes their courfe, or when the obftacles are not fufficient to ftop them. Speculative philofophy inveftigates its caufe, and perhaps in vain. Experimental philofophy contents itfelf with defcribing the phenomena, and teaching the laws of gravity, which are thoroughly eftablifhed by a thoufand reiterated experiments. In order properly to underftand this fubject, we muft take care not to confound the term *gravity* with that of *weight*. By the former, we underftand that force which urges bodies to defcend through a certain fpace in a given time. By the latter, is meant the quantity of a heavy body that is contained under the fame bulk. The phenomena are explained by the experiments themfelves, and by inferences deduced from them.

VII. Hydroftatics is a fcience of which the object is the gravity and equilibrium of fluids in particular. Though the gravity of thefe bodies is the fame with that of others, and is fubject to the fame laws, yet their ftate of fluidity gives rife to particular phenomena, which it is of confequence to know. But as hydroftatics cannot be fucceffully treated on without the affiftance of calculation, it has been ranked among the mathematical fciences.

VIII. We fay the fame with regard to mechanics; which is the art of employing, by the aid of machines, the

the motion of bodies, in conformity to its properties and laws, as well with regard to ſolids as fluids, either more commodiouſly or more advantageouſly.

IX. After it has made the moſt accurate experiments, and the moſt judicious obſervations, on all theſe different ſubjects, and the properties of bodies in particular, Experimental Philoſophy paſſes to the examination of the air, the water, fire, the wind, colours, &c. The air is a fluid with which we are ſurrounded from the inſtant of our birth, and without which we cannot exiſt. It is by the properties and the influences of the air, that nature gives increaſe and perfection to all that it produces for our wants and conveniences: it is the ſpirit of navigation: ſound, voice, ſpeech itſelf, are nothing more than percuſſions of the air: this globe that we inhabit is completely ſurrounded by air; and this kind of coverture, which is commonly called the *atmoſphere*, has ſuch remarkable functions, that it evidently appears to concur to the mechaniſm of nature. Experimental phyſics, therefore, conſiders the air, 1. Of itſelf, independent of its bulk, and the figure of its whole body: it examines its eſſential properties; as its gravity, denſity, ſpring, &c. The air-pump is here of indiſpenſable uſe; and by this machine phyſics examines in what manner ſpace, or a vacuum, is made. It likewiſe ſhows the neceſſity of air to the preſervation of animal life; the effect it has on ſound, fire, and gunpowder, *in vacuo*; and a hundred other experiments of various degrees of curioſity. 2. It conſiders the air as the terreſtrial atmoſphere, ſometimes as a fluid at reſt, and ſometimes as in motion. And by theſe means it accounts for the variation of the mercury in the barometer, and why it ſinks in proportion as the height of the atmoſphere diminiſhes; as alſo for the figure, the extent, and weight of the atmoſphere: it ſhows the method of determining the height of mountains, the nature of ſound in general, of its propagation, and of ſonorous bodies. The late diſcoveries have added greatly to experimental philoſophy, of which an account is given under the article CHEMISTRY, &c.

X. It is here alſo, that experimental philoſophy conſiders the nature of the wind; which is nothing more than agitated air, a portion of the atmoſphere that moves like a current, with a certain velocity and determinate direction. This fluid, with regard to its direction, takes different names according to the different points of the horizon from whence it comes, as eaſt, weſt, north, and ſouth. Winds are likewiſe diſtinguiſhed into three ſorts; one of which is called *general* or *conſtant*, as the trade winds which continually blow between the tropics: another is the *periodical*, which always begin and end within a certain time of the year, or a certain hour of the day, as the monſoons, the land breezes and ſea breezes, which ariſe conſtantly in the morning and evening; and laſtly, ſuch as are *variable*, as well with regard to their direction as their velocity and duration.

M. Mariotte computes the velocity of the moſt impetuous wind to be at the rate of 32 feet in a ſecond, and Mr Derham makes it 66 feet in the ſame time. The firſt, doubtleſs, meant the wind of the greateſt velocity that had then come to his knowledge. The invention of aeroſtatic machines has tended more to ſhow the real velocity of the wind than any other invention as yet made public: but all of them move ſlower than the aerial current; ſo that the real velocity of the wind remains yet undetermined.

XI. The force of the wind, like that of other bodies, depends on its velocity and maſs: that is, the quantity of air which is in motion; ſo the ſame wind has more or leſs force on any obſtacle that oppoſes it, in proportion as that obſtacle preſents a greater or a leſs ſurface: for which reaſon it is that they ſpread the ſails of a veſſel more or leſs, and place the wings of a windmill in different directions. The machines by which the winds are meaſured, are called *anemometers*. They ſhow the direction, the velocity, and the duration of winds. It is by the agitations of the winds that the air is purified; that the ſeeds of trees and herbs are conveyed through the foreſts and fields; that ſhips are driven from one pole to the other; that our mills turn upon their axles, &c.: and art, by imitating nature, ſometimes procures us artificial winds, by which we refreſh our bodies, invigorate our fires, purify our corn, &c.

XII. Water is an univerſal agent, which nature employs in all her productions, It may be conſidered as in three ſtates: 1. As a liquid; 2. As a vapour; 3. As ice. Theſe three different ſtates do not in any manner change its eſſence, but make it proper to anſwer different ends. The natural ſtate of water would be that of a ſolid body, as fat, wax, and all thoſe other bodies which are only fluid when heated to a certain degree; for water would be conſtantly ice, if the particles of fire, by which it is penetrated in the temperate climates, did not render it fluid, by producing a reciprocal motion among its parts; and, in a country where the cold is continually ſtrong enough to maintain the congelation, the aſſiſtance of art is neceſſary to make it fluid in the ſame manner as we do lead, &c. Water, when not in ice, is a fluid that is inſipid, tranſparent, without colour and without ſmell, and that eaſily adheres to the ſurface of ſome bodies, that penetrates many, and extinguiſhes fire. Experimental philoſophy inveſtigates the origin of fountains; the cauſe of the ſaltneſs of the ſea; the means of purifying water; what is its weight, and what are its effects when heated, &c. It likewiſe examines this fluid in the ſtate of vapour; and finds that a drop of water, when in vapour, occupies a ſpace vaſtly greater than it did before. It explains the *æolipile* and its effects; fire engines; and the force of vapour that gives motion to immenſe machines in mines and elſewhere, &c. And laſtly, It conſiders water in the ſtate of ice. Ice conſequently is more cold than water; and its coldneſs increaſes if it continue to loſe that matter, already too rare, or too little active, to render it fluid. Experimental phyſics endeavours to inveſtigate the cauſes of the congelation of water, and why ice is lighter than water; from whence it derives that expanſive force by which it breaks the containing veſſel; the difference there is between the congelation of rivers and that of ſtanding waters; why ice becomes more cold by the mixture of ſalts; and many other ſimilar phenomena.

XIII. The nature of fire is yet very much unknown to the moſt learned philoſophers. As objects when at a great diſtance are not perceptible to our ſenſes, ſo when we examine them too nearly, we diſcern them but confuſedly. It is ſtill diſputed whether fire be a homogene, unalterable matter, deſigned, by its preſence, or by its action,

action, to produce heat, inflammation, and diſſolution, in bodies: or if its eſſence conſiſts in motion only, or in the fermentation of thoſe particles which we call *inflammable*, and which enter as principles, in greater or leſs quantities, in the compoſition of mixed bodies. The moſt learned inquirers into nature incline to the former opinion; and to have recourſe to a matter which they regard as the principle of fire. They ſuppoſe that there is in nature a fluid adapted to this purpoſe, created ſuch from the beginning, and that nothing more is neceſſary than to put it in action. The numberleſs experiments which are daily made in electricity ſeem to favour this opinion, and to prove that this matter, this fluid, this elementary fire, is diffuſed through all nature, and in all bodies, even ice itſelf. We cannot ſay to what important knowledge this great diſcovery of electricity may lead if we continue our inquiries concerning it. It appears, however, that we may believe, without any inconvenience or abſurdity, that fire and light, conſidered in their firſt principle, are one and the ſame ſubſtance differently modified.

XIV. Be this matter however as it may, experimental philoſophy is employed in making the moſt ingenious and moſt uſeful reſearches concerning the nature of fire, its propagation, and the means by which its power may be excited or augmented; concerning the phoſphorus and its inflammation; fire excited by the reflection of the ſun's rays from a mirror; and on the effects of fire in general; concerning lightning and its effects; the fuſion of metals; gunpowder and its exploſion; flame and the aliments of fire; and an infinity of like objects which it explains, or concerning which it makes new diſcoveries, by the aid of experiments.

XV. By the word *light*, we underſtand that agent by which nature affects the eye with that lively and almoſt conſtantly pleaſing ſenſation, which we call *ſeeing*, and by which we diſcern the ſize, figure, colour, and ſituation of objects, when at a convenient diſtance. All philoſophers agree, that the light, which is diffuſed in any place, is a real body. But what this body is, and by what means it enters that place where it is perceived, is a queſtion about which philoſophers are divided.

XVI. Experimental philoſophy is applied in diſcovering or proving, by an infinity of experiments, what is the nature of light, in what manner it is propagated, what its velocity and progreſſive motion. It alſo inveſtigates and explains the principles of *optics* properly ſo called, and ſhows the directions which light obſerves in its motions. From thence it proceeds to the examen of the principles of catoptrics, and deſcribes the laws and effects of reflected light. It next treats of the principles of dioptrics, and explains the laws of refracted light; and laſtly, it teaches, from the principles of natural and artificial viſion, the conſtruction of optical inſtruments, as lenſes, concave mirrors, priſms, teleſcopes, &c. &c. and the uſes to which they are applied.

XVII. By reſolving or ſeparating the rays of light, philoſophy has obtained true and clear diſcoveries of the nature of colours. We are naturally led to imagine that colours, and their different degrees, make a part of the bodies that preſent them to our ſight; that white is inherent in ſnow, green in leaves and graſs, and red in a ſtuff dyed of that colour. But this is far from being true. If an object, which preſents any colour to our ſight, be not illuminated, it preſents no colour whatſoever. In the night all is black. Colours therefore depend on light; for without that we could form no idea of them; but they depend alſo on bodies; for of ſeveral objects preſented to the ſame light, ſome appear white, others red, blue, &c. But all theſe matters being ſeparate from our own bodies, we ſhould never acquire any ideas of them, if the light, tranſmitted or reflected by theſe objects, did not make them ſenſible to us, by ſtriking upon the organs of our ſight, and if theſe impreſſions did not revive in us thoſe ideas which we have been uſed to expreſs by certain terms. For theſe reaſons philoſophy conſiders colours from three points of view, 1. As in the light; 2. In bodies, as being coloured; and, 3. From the relation they have to our viſual faculties, which they particularly affect, and by which we are enabled to diſtinguiſh them.

It is unneceſſary in this place to ſay more either on colour in particular or experimental philoſophy in general. The different ſubjects of this collective article are particularly treated under their proper names, in the order of the alphabet: the reader will therefore turn, as he has occaſion, to ACOUSTICS, CATOPTRICS, CHROMATICS, DIOPTRICS, HYDROSTATICS, MECHANICS, OPTICS, PNEUMATICS, ELECTRICITY, MAGNETISM, &c. &c. &c. Alſo, AEROSTATION, ATMOSPHERE, *BURNING Glaſs*, CHEMISTRY, &c. &c.

E X P

Experimentum || Expiation.

EXPERIMENTUM CRUCIS, a capital, leading, or deciſive experiment; thus termed, either on account of its being like a croſs, or direction-poſt placed in the meeting of ſeveral roads, guiding men to the true knowledge of the nature of that thing they are inquiring after; or, on account of its being a kind of torture, whereby the nature of the thing is as it were extorted by force.

EXPHORESIS. See ORATORY, N° 85.

EXPIATION, a religious act, by which ſatisfaction or atonement is made for the commiſſion of ſome crime, the guilt done away, and the obligation to puniſhment cancelled. Expiation.

Expiations among the Heathens, were of ſeveral kinds; as ſacrifices and religious waſhings. They were uſed for effacing a crime, averting any calamity, and on numberleſs other occaſions, as purifying towns, temples, and ſacred places, and armies before and after battle. And they were performed for whole cities as well as particular perſons.

The

Expiation || Explofion.

The method of expiation among the Jews was chiefly by ſacrifice, whether for ſins of ignorance, or to purify themſelves from certain pollutions.

Feaſt of EXPIATION, among the Jews, called by our tranſlators the *day of atonement*, was held on the tenth day of Tiſri, or the ſeventh month of the Jewiſh year, anſwering to part of our September and October. It was inſtituted by God himſelf, Levit. xxiii. 27, &c. On that day the high-prieſt, the figure or type of Jeſus Chriſt, entered into the moſt holy place, and confeſſed his ſins; and, after ſeveral ceremonies, made an atonement for all the people, to waſh them from their ſins. Lev. chap. xvi. See *Scape-Goat*.

EXPIATION, in a figurative ſenſe, is applied by divines to the pardon procured to the ſins of the penitent by the merit of Chriſt's death. See the article CHRISTIANITY.

EXPIRATION, in *Medicine*. See EXSPIRATION.

EXPIRATION, is alſo uſed figuratively, for the end of a term of time granted, agreed on, or adjudged.

EXPLICIT, in the ſchools, ſomething clear, diſtinct, formal, and unfolded.

EXPLOSION, in *Natural Philoſophy*, a ſudden and violent expanſion of an aerial or other elaſtic fluid, by which it inſtantly throws off any obſtacle that happens to be in the way, ſometimes with incredible force, and in ſuch a manner as to produce the moſt aſtoniſhing effects upon the neighbouring objects.

Difference between exploſion and expanſion.

Exploſion differs from expanſion, in that the latter is a gradual and continued power, acting uniformly for ſome time, whereas the former is always ſudden, and only of momentary duration. The expanſions of ſolid ſubſtances do not terminate in violeat exploſions, on account of their ſlowneſs, and the ſmall ſpace through which the metal, or other expanding ſubſtance, moves; though their ſtrength may be equally great with that of the moſt active aerial fluids. Thus we find, that though wedges of wood, when wetted, will cleave ſolid blocks of ſtone, they never throw them to any diſtance, as is the caſe with gunpowder. On the other hand, it is ſeldom that the expanſion of any elaſtic fluid burſts a ſolid ſubſtance without throwing the fragments of it to a conſiderable diſtance, the effects of which are often very terrible. The reaſons of this may be compriſed in the two following particulars:

General cauſes of exploſions.

1. The immenſe velocity with which the aerial fluids expand, when affected by a conſiderable degree of heat; and, 2. Their celerity in acquiring heat and being affected by it, which is much ſuperior to that of ſolid ſubſtances. Thus air, heated as much as iron when brought to a white heat, is expanded to four times its bulk; but the metal itſelf will not be expanded the 500th part of the ſpace. In the caſe of gunpowder, which is a violent and well known explofive ſubſtance, the velocity with which the flame moves is calculated by Mr Robins, in his Treatiſe upon Gunnery, to be no leſs than 7000 feet in a ſecond, or little leſs than 79 miles per minute. Hence the impulſe of the fluid is inconceivably great, and the obſtacles on which it ſtrikes are hurried off with vaſt velocity, though much leſs than that juſt mentioned; for a cannon bullet, with the greateſt charge of powder that can be conveniently given, does not move at a greater rate than 2400 feet per ſecond, or little more than 27 miles per minute. The velocity of the bullet again is promoted by the ſudden propagation of the heat through the whole body of air, as ſoon as it is extricated from the materials of which the gunpowder is made; ſo that it is enabled to ſtrike all at once, and thus greatly to augment the momentum of the ball. It is evident that this contributes very much to the force of the exploſion, by what happens when powder is wetted or mixed with any ſubſtance, which prevents it from taking fire all at once. In this caſe the force of the exploſion, even when the ſame quantity of powder is made uſe of, cannot be compared to that of dry powder.

Exploſion

Upon theſe principles we may conclude, that the force of an exploſion depends, 1. On the quantity of elaſtic fluid to be expanded; 2. On the velocity it acquires by a certain degree of heat; and, 3. On the celerity with which the degree of heat affects the whole of the expanſile fluid. Theſe three take place in the greateſt perfection where the electric fluid is concerned; as in caſes of lightning, earthquakes, and volcanoes. This fluid, as is ſhown in many parts of this work, differs not from elementary fire or the light of the ſun; it pervades the whole ſyſtem of nature; its expanſion is nothing elſe than its motion from a centre towards a circumference, for it does not ſeem capable of any proper expanſion by a ſeparation of its parts like any other fluid. Hence, when it begins to expand in this manner, the motion is propagated through it with a velocity far exceeding that of any other fluid whatever. Thus, even when the quantity is exceſſively ſmall, as when an electric ſpark is ſent through a glaſs full of water or of oil, the expanſion is ſo violent as to diſſipate the glaſs into innumerable fragments with great danger to the by-ſtanders, as is obſerved under the article ELECTRICITY. In violent lightning, where the electric fluid collects itſelf into balls, the ſtrength of the exploſion is proportionable to the quantity. Every one has heard of the prodigious effects of lightning when it happens to ſtrike buildings, trees, or even the moſt ſolid rocks; and in ſome caſes, where the quantity of electricity is ſtill greater than in any flaſh of lightning, we hear of ſtill more tremendous conſequences enſuing. Dr Prieſtley gives an inſtance of a large fire ball (undoubtedly a quantity of electric matter) rolling on the ſurface of the ſea, which after riſing up to the top-maſt of a ſhip of war, burſt with ſuch violence that the exploſion reſembled the diſcharge of hundreds of cannon fired at once. Great damage was done by it; but there is not the leaſt doubt that moſt of its force was ſpent on the air, or carried down to the ſea by the maſt and iron work of the ſhip. Indeed, conſidering that in all caſes a great part of the force of electric exploſions is diſſipated in this manner, it may juſtly be doubted whether they can be meaſured by any method applicable to the menſuration of other forces. Even in artificial electricity the force is prodigiouſly great; inſomuch that Dr Van Marum calculated that of the great battery belonging to the machine in Teyler's muſeum to be upwards of 900 pounds.

Electric exploſions the ſtrongeſt of all.

In thoſe caſes where the electrical matter acts like common fire, the force of the exploſions, though exceedingly great, is capable of meaſuration by comparing the diſtances to which the bodies are thrown with their weight. This is moſt evident in volcanoes, where the projections of the burning rocks and lava manifeſt

Volcanic exploſions next in ſtrength.

Explosion.

the greatness of the power, at the same time that they afford a method of measuring it. These explosions, as is shown under the article VOLCANO, are owing to extrication of aerial vapours, and their rarefaction by intense heat. In all of them the air is originally in a state of decomposition, viz. its invisible and solid part is joined with some terrestrial substances. Thus, when fixed air, for instance, is exposed to any pure earth which attracts it, as calcined magnesia, a decomposition instantly takes place. All these vapours are composed of elementary fire and some invisible substance capable of assuming a solid form. The decomposition just mentioned is therefore easily explained; the solid part of the air joins itself to the magnesia, while the elementary fire or latent heat is dissipated, and passes through the sides of the vessel. Were it now in our power suddenly to restore the latent heat to the whole of the fixed air, so that it would at once assume its former expansion, a violent explosion would follow. This seems to be precisely the case with the volcanic explosions. An immense quantity of the fixed part of different aerial fluids is united to the various substances found below the surface of the earth. By means of the electric fire which kindles the volcanoes, the aerial fluids are suddenly restored to their elastic state; and not only so, but their natural elasticity is greatly augmented, so that the explosions take place with great violence. The case is the same with gunpowder; only that the condensed air in this case is at first of the dephlogisticated kind, but is quickly phlogisticated by reason of the combustible matters mixed with the nitre, while the heat produced by the inflammation augments the elasticity of the generated air to four times what it usually is, so that the whole force of the explosion is calculated at 1000 times the pressure of the common atmosphere †. Thus the explosions of gunpowder and of volcanoes are essentially the same. The reason of the extreme quickness of those of gunpowder is, that it takes fire so readily by the intimate mixture and combustibility of all the materials. In volcanoes the explosions likewise follow one another very quickly, and are by no means inferior in strength to those of gunpowder: but here the quantity of vapour makes up for the comparative slowness with which it is affected by the heat. Thus, though we could not by any means contrive to fire cannon in quick succession by means of calcareous earth as we can do with gunpowder, yet in the huge furnace of a volcano the elastic matter is supplied in such quantities, that the explosions are in a manner unremitting; and even in ordinary experiments the confinement of aerial vapours has often occasioned violent explosions in chemical vessels. In one case too the extrication of fixed air adds excessively to the force of an explosion, viz. in that of pulvis fulminans. This is compounded of sulphur, saltpetre, and salt of tartar. The latter we know contains much fixed air: and it is probable that the violence of the explosion is occasioned by this air; for the greater quantity of it that the alkaline salt contains, the greater force does it explode with. Fulminating gold emits a quantity of phlogisticated air, to which its explosive power is supposed to be owing, as is explained under the article CHEMISTRY; but that of fulminating silver is so extraordinary, that scarce any force of aerial vapour that can be extricated is likely to produce it, and it seems probable that electricity itself is concerned.

In what manner aerial explosions take place.

Explosion of gunpowder explained.

† See the article *Gunnery*.

Of pulvis fulminans, &c.

Next in strength to the aerial vapours are those of aqueous and other liquids. The most remarkable effects of these are observed in steam engines; but there is one particular case from which it has been inferred that aqueous steam is vastly stronger than the flame of gunpowder. This is when water is thrown upon melted copper; for here the explosion is so strong as almost to exceed imagination; and the most terrible accidents have been known to happen from such a slight cause as one of the workmen spitting in the furnace where copper was melting. Here, however, it is most probable that a decomposition of the water takes place. That this element can be decomposed, or resolved into elastic vapours, has been completely established by the most satisfactory experiments, and is now, we believe, universally admitted by chemical philosophers. See WATER, CHEMISTRY *Index*. The position is indeed denied by the phlogistians; but their arguments appear not to be conclusive; nor is it a fact which militates in the least against their principles. On the supposition that the water is decomposed in the present case, however, the phenomenon in question is easily solved. The water being thrown in substance upon the melted copper, is decomposed by the violent heat; and one part of it adheres to the metal, thus converting it into a calx, or oxide, while the other is converted into inflammable air, or hydrogen gas, which expanding suddenly, throws the melted metal all about with the greatest violence by means of its reaction.

Explosions by aqueous vapours.

Violent explosion of water with melted copper.

Probably owing to a decomposition of the water.

Particularly explained.

To understand the manner in which this is accomplished, we must consider some of the principles of GUNNERY laid down by Mr Robins, and related under that article. One of these is, that though the air, in cases of ordinary velocity, makes no great resistance, it is far otherwise where the velocity of the moving body becomes very great. In all cases of explosion also there is in the first instance a resisting vacuum made by the exploding fluid; and consequently the weight of the atmosphere is to be overcome, which amounts to about 14 pounds on every square inch of surface. Supposing the surface of the exploding fluid, then, on that of melted copper, to contain an area of 4 square inches, it meets with a resistance of 60 pounds from the atmosphere, and consequently communicates an equal pressure to the fluid metal. Even this must of consequence throw it about, unless the same pressure was exactly diffused over every part of the surface. But much more must this effect be increased by the immense velocity with which the fluid moves, and by which the resistance of the atmosphere is augmented in a prodigious degree, as is explained under the article GUNNERY. The elastic fluid generated is then confined not only by the fluid metal and sides of the furnace, but by the air itself, which cannot get out of the way; so that the whole resembles a cannon closed at the mouth, and filled with inflamed gunpowder. Hence not only the melted metal, but the furnace itself and the adjacent walls of the building, are hurried off as they would be by the firing of a great quantity of gunpowder in a small space, and which is well known to produce analogous effects.

In explaining the phenomenon in question, Dr Black supposes that the mere heat of the metal applied to the aqueous

Explosion.

aqueous steam produces the explosion; and in proof of this alleges, that copper imbibes a greater quantity of heat during fusion than any other metal. Aqueous steam, however, seems to be too slow for producing such sudden and violent effects. Explosions, it is true, will be occasioned by it, but then it must be confined for a very considerable time; whereas the effects of water thrown upon melted copper are instantaneous.

Is not owing to mere aqueous steam intensely heated.

Why such explosions do not take place with other metals.

It may now be asked, Why such explosions do not take place with any other metal, iron for instance, when water is thrown upon its surface in fusion? In answer to this we must observe, That though water is decomposed by being applied to red-hot iron in the form of steam, yet there is a possibility, that when the same element is applied in substance to the fluid metal, no decomposition may ensue. Something like this indeed happens with copper itself; for, notwithstanding the violent effects which take place on the contact of water in substance with the melted metal, no explosion happens though aqueous steam be blown upon its surface. On the contrary, the upper part of the metal is thus cooled, and forms itself into cakes, which are afterwards taken off, and new ones formed in the same manner; neither does aqueous steam affect red-hot copper in the manner that it does iron in the same state. A decisive proof that the explosion is not occasioned by the mere heat of the aqueous steam may be deduced from the example of melted glass, which produces no explosion though we pour water upon it in that state; and yet the heat of melted glass is undoubtedly equal at least to that of melted copper. It must be observed, however, that in all cases where a very hot body is thrown upon a small quantity of water in substance, an explosion will follow; but here the water is confined and suddenly rarefied into steam, which cannot get away without throwing off the body which confines it. Examples of this kind frequently occur where masons or other mechanics are employed in fastening cramps of iron into stones; where, if there happens to be a little water in the hole into which the lead is poured, the latter will fly out in such a manner as sometimes to burn them severely. Terrible accidents of this kind have sometimes happened in founderies, when large quantities of melted metal have been poured into wet moulds. In these cases, the sudden expansion of the aqueous steam has thrown out the metal with violence; and if any decomposition has taken place at the same time, so as to convert the aqueous into an aerial vapour, the explosion must be still greater.

Explosions when heated substances are thrown upon small quantities of water.

By pouring cold water into boiling oil.

To this last kind of explosion we must refer that which takes place on pouring cold water into boiling or burning oil or tallow. Here the case is much the same whether we pour the oil on the water, or the water on the oil. In the former case, the water which lies at the bottom is rarefied into steam, and explodes; in the latter, it sinks down through the oil by its superior specific gravity, and explodes as it passes along. In either case, however, the quantity of aqueous fluid must be but small in proportion to that of the oil: a very great quantity would put out the flame, or destroy the heat, in whatever way we applied it.

Explosions in fluid substances explained.

Another kind of explosion is that which takes place in solid substances, where we can scarcely suppose either aqueous or aerial vapours to be concerned. The most remarkable of these are the *volcanic bombs* mentioned by Sir William Hamilton in the great eruption of Vesuvius in 1779. They were large pieces of lava which burst in pieces like bombs as they fell to the ground; but he does not inform us whether their bursting was attended with any great violence or not. Indeed, amidst such scenes of horror, and the continual tremendous explosions of the volcano, smaller phenomena of this kind would probably be overlooked. Other examples are the *Glass Tears*, of which an account is given under that article; the bursting of electrical globes, when put in motion; of other glass vessels spontaneously, and seemingly without any cause; and lastly, the bursting of large cast metal vessels in the act of cooling. These are all so similar to one another, that it is probable they depend on one general cause. All of them agree in this respect, that the extreme parts of them are considerably cooled, while the internal remain very hot. Thus, in the volcanic bombs, the current of air, formed by their swift passage through it in falling, necessarily carries off a great quantity of heat from the parts which are in contact with it, while the rest are scarce at all cooled. The glass-tears are artificially cooled on the outside by dropping them upon water; and in consequence of this, their explosion is probably more violent in proportion to their bulk than that of the volcanic bombs. Glass vessels only burst spontaneously when they have not been well annealed; and we know that this bad annealing consists only in applying cold too suddenly to the outside. Something like this probably takes place when cast-iron vessels explode; and we are certain it does so with electrical globes, for these last are not apt to burst if they have been well annealed. In all cases, therefore, there is a remarkable contraction of the outward surface by the cold, while the internal parts remain as much expanded as ever. In this case there must be a continual effort of that subtile fluid called *elementary fire*, from the internal to the external part, as the contraction gradually proceeds the contrary way. Thus, when a volcanic bomb, for instance, is cooled on the outside, its parts are consolidated so that the internal fluid has not such an easy passage through it as is necessary. In consequence of this it makes a greater effort, which is still farther augmented by the cooling and contraction of the internal parts squeezing the fluid out from among themselves, and forcing it to recoil upon that in the centre, as well as to exert itself against the external part; from which united operation the effect already mentioned at last takes place. This explanation, however, does not hold with respect to electrical globes, glass tears, or ill annealed glass: but in order to accommodate it to all these, we have only to remember, that *fire*, and the electric fluid acting from a centre to a circumference, are not in the least different; so that from whatever cause the electric matter is disposed to act in this manner, the same effect will follow, i. e. an explosion will take place if the substance does not afford an equally ready passage through all its parts, and that whether any sensible heat is felt in it or not.

Explosion.

Explosion of hydrogen and oxygen air.

The only other kind of explosion we have to take notice of is that produced by inflammable and dephlogisticated air, or oxygen and hydrogen gases, when mixed together and set on fire. This differs from any of those hitherto considered, because in reality there is an abso-

lute

Explosion. late condensation rather than an expansion throughout the whole of the operation; and the result is the formation of water; and could the airs be made to take fire throughout their whole substance absolutely at the same instant, there would be no explosion, but only a sudden production of heat. From this cause also is derived a very singular phenomenon taken notice of by Dr Priestley in his experiments on that subject, recorded in the Phil. Trans. Having enclosed several quantities of inflammable and dephlogisticated air in a copper vessel, firing them afterwards by the electric sparks, he found that the force of the explosion was directed more towards one part of the vessel than another; least on that part where the electrical discharge was made, and most upon that which was farthest from it. This inequality was very considerable; insomuch that he could not repeat his experiments any number of times without injuring the vessel in that part which was farthest from the discharge. The reason he gives for this is, that the mixture was not fired at the same instant, but first at the place where the discharge was made. This first explosion would have acted equally upon all parts of the vessel, had it not been for the intervention of the air. By the first momentary explosion, however, the air in the farthest part of the vessel was condensed, so that the next explosion was made stronger, while the copper in the fore part of the vessel had the whole of this strong explosion to resist, the hinder part being but little concerned, as the air in it was condensed and reduced almost to a vacuum.

Singular phenomenon observed by Dr Priestley.

Though the phenomena of explosions are sometimes very destructive, they are likewise of considerable use in life, by removing obstacles which could scarcely be got the better of by any mechanical power whatever. The principal of these are the blowing up of rocks, the separating of stones in quarries, and other purposes of that kind. The destruction occasioned by them in times of war, and the machines formed upon the principle of explosion for the destruction of the human race, are well known; and if we cannot call these *useful*, we must allow them at least to be necessary evils. For the production of explosions, gunpowder is the only substance that has yet been found to answer; nevertheless, as its use is attended with considerable expence, several attempts have been made to find out a cheap substitute for it. One of the most remarkable of these was by mixing small quantities of water, enclosed in little bladders or some easily destructible vehicles, along with a charge of powder. By this contrivance it was hoped that the water being converted into vapour when the powder was inflamed, would augment the force of the explosion: but instead of this, it was found greatly to diminish it. The reason was evident, viz. that the conversion of the water into steam required so much of the latent heat of the inflamed gunpowder, that enough was not left to give the necessary expansion to the aerial fluid produced. A mixture of hydrogen and oxygen gases has also been tried; but the explosion here has always been found too weak. In mines, indeed, very terrible effects are produced by such a mixture, but in these the quantity is immense; so that the comparative weakness of the mixture cannot be discovered. Electricity therefore seems to be the only resource we have; except by adding ingredients to gunpowder which may increase the strength of it. There can be no doubt indeed that the electric fluid is possessed of sufficient strength to perform every thing we could desire; and electricians have supposed, perhaps justly enough, that a cannon charged with water might, by means of electricity, become more dangerous than one charged with gunpowder: but this fluid is so exceedingly capricious, so imperceptible and unmanageable, that the use of it cannot as yet be thought practicable, nor in all probability ever will be so.

Uses to which explosions are applied.

Attempts to supersede the use of gunpowder.

Explosion || Exportation.

The effects of explosions, when violent, are felt at a considerable distance, by reason of the concussions they give to the atmosphere; for, as has been already hinted, all of them act upon the atmospherical fluid with the very same force they exert upon terrestrial substances subjected to their action. Sir William Hamilton relates, that at the explosions of Vesuvius in 1767, the doors and windows of the houses at Naples flew open if unbolted, and one door was burst open though it had been locked. A great quantity of gunpowder being put into the ditch of a fortified city, and set on fire, destroyed part of the wall, and broke down one of the gates. The blowing up of powder magazines or powder mills will destroy buildings and kill people, though certainly without the reach of the flame, and untouched by any part of the shattered magazine or mill. But the most curious effect is, that they electrify the air, and even glass windows, at a considerable distance. This is always observable in firing the guns of the Tower at London; and some years ago, after an explosion of some powder mills in the neighbourhood of that city, a great number of people were alarmed by a rattling and breaking of their china ware; which by the vulgar was taken for a supernatural phenomenon, but undoubtedly was owing to some commotion in the electrical fluid from the violent concussion of the atmosphere. In this respect, however, the effects of electrical explosions themselves are most remarkable, though not in the uncommon way just mentioned; but it is certain, that the influence of a flash of lightning is diffused for a great way round the place where the explosion happens, producing many very perceptible changes both on the animal and vegetable creation.

Effects of explosions on the atmosphere and electric fluid.

EXPONENT, in *Algebra*, the same with index. See ALGEBRA.

EXPONENT is also used in arithmetic, in the same sense as index or logarithm.

Exponential Calculus, the method of differencing, or finding the fluxions of exponential quantities, and of summing up those differences, or finding their fluents.

Exponential Curve, is that whose nature is defined or expressed by an exponential equation; as the curve denoted by $a^x = y$, or by $x^x = y$.

Exponential Equation, is one in which is contained an exponential quantity; as the equation $a^x = b$, or $x^x = a\,b$, &c.

Exponential Quantity, is that whose power is a variable quantity; as the expression a^x, or x^y. Exponential quantities are of several degrees and orders, according to the number of exponents or powers, one over another.

EXPORTATION, the shipping and carrying out of the kingdom wares and commodities for other countries. See the articles COMMERCE, TRADE, and SHIPPING.

EXPOSING,

Expoſing || Expoſitor.

EXPOSING, the act of ſetting a thing to public view. In the Romiſh church, the ſacrament is ſaid to be *expoſed* when it is ſhown in public uncovered on feſtival days, and during the time of plenary indulgences.

EXPOSING is alſo uſed with a farther latitude; thus we ſay, It is prohibited to expoſe falſe and clipped money. Such a houſe ſtands very high, and has a delicious proſpect; but it is expoſed to all the four winds. Such a city being on the frontiers, and not fortified, is expoſed to the inſults of every party of forces.

EXPOSING of Children, a barbarous cuſtom practiſed by moſt of the ancients excepting the Thebans, who had an expreſs law to the contrary, whereby it was made capital to expoſe children; ordaining at the ſame time, that ſuch as were not in a condition to educate them ſhould bring them to the magiſtrates, in order to be brought up at the public expence. Among the other Greeks, when a child was born, it was laid on the ground; and if the father deſigned to educate his child, he immediately took it up; but if he forbore to do this, the child was carried away and expoſed. The Lacedemonians indeed had a different cuſtom; for with them all new-born children were brought before certain triers, who were ſome of the graveſt men in their own tribe, by whom the infants were carefully viewed; and if they were found luſty and well favoured, they gave orders for their education, and allotted a certain proportion of land for their maintenance; but if weakly or deformed, they ordered them to be caſt into a deep cavern in the earth, near the mountain Taygetus, as thinking it neither for the good of the children themſelves nor for the public intereſt, that defective children ſhould be brought up. Many perſons expoſed their children only becauſe they were not in a condition to educate them, having no intention that they ſhould periſh. It was the unhappy fate of daughters eſpecially to be thus treated, as requiring more charges to educate and ſettle them in the world than ſons.

The parents frequently tied jewels and rings to the children they expoſed, or any other thing whereby they might afterwards diſcover them, if Providence took care for their ſafety. Another deſign in adorning theſe infants was either to encourage ſuch as found them to nouriſh and educate them, if alive, or to give them human burial if dead. The places where it was uſual to expoſe children were ſuch as people frequented moſt. This was done in order that they might be found, and taken up by compaſſionate perſons who were in circumſtances to be at the expence of their education. With this intention the Egyptians and Romans choſe the banks of rivers, and the Greeks the high-ways.

EXPOSITION, in general, denotes the ſetting a thing open to public view. See EXPOSING.

EXPOSITION, in a literary ſenſe, the explaining an author, paſſage, writing, or the like, and ſetting their meaning in an obvious and clear light.

EXPOSITOR, or EXPOSITORY, a title which ſome writers have given to a leſſer kind of dictionaries or vocabularies, ſerving to expound or explain the meaning of the obſcure or difficult words of a language. It is alſo uſed in the ſame ſenſe with commentary and paraphraſe.

Expoſtulation || Extenſor.

EXPOSTULATION, in *Rhetoric*, a warm addreſs to a perſon who has done another ſome injury, repreſenting the wrong in the ſtrongeſt terms, and demanding redreſs.

EXPOSURE, in *Gardening*, the ſituation of a garden wall, or the like, with reſpect to the points of the compaſs, as ſouth or eaſt. See GARDENING.

Ex-poſt-facto, in *Law*, denotes ſomething done after another thing that was committed before. An eſtate granted may be made good by matter *ex-poſt-facto*, that was not ſo at firſt by election, &c.

EXPRESSED OILS, ſuch oils as are obtained from bodies only by preſſing. See CHEMISTRY and MATERIA MEDICA *Index*.

EXPRESSION, in *Rhetoric*, the elocution, diction, or choice of words in a diſcourſe. See LANGUAGE, ORATORY, and POETRY.

EXPRESSION, in *Muſic*. See COMPOSITION.

EXPRESSION, in *Painting*, a natural and lively repreſentation of the ſubject, or of the ſeveral objects intended to be ſhown.

The expreſſion conſiſts chiefly in repreſenting the human body and all its parts, in the action ſuitable to it: in exhibiting in the face the ſeveral paſſions proper to the figures, and obſerving the motions they impreſs on the external parts. See PAINTING.

EXPRESSION, Theatrical. See DECLAMATION, Article iv.

EXPRESSION, in *Medicine*, *Chemiſtry*, &c. the act of expreſſion or extracting the juices or oils of plants, fruits, or other matters, by ſqueezing, wringing, or preſſing them in a preſs. After having let the herbs infuſe a due time, their juice muſt be drawn by expreſſion in a linen cloth or by a preſs.

EXPULSION, in a general ſenſe, the act of violently driving a perſon out of any city, ſociety, &c.

EXPULSION, in *Medicine*, the act whereby any thing is forcibly driven out of the place in which it is: thus we ſay, the expulſion of the fetus in delivery.

EXSICCATION, (formed of *ex* and *ſiccus*, "dry,") in *Chemiſtry*, &c. the act of drying up or evaporating the moiſture of a thing.

EXSPIRATION, in *Phyſic*, that part of reſpiration by which the air is expelled or driven out of the lungs. See ANATOMY *Index* and RESPIRATION.

EXSUDATION, or EXUDATION, the act of ſweating out. In which manner, gums, balſams, &c. are uſually produced from trees.

EXTANT, ſomething that ſtill ſubſiſts, or is in being. It is but part of the hiſtory of Livy, of the writings of Cicero, Cæſar, &c. that are extant, the reſt are loſt. We have nothing extant of Socrates, though he wrote a great deal.

EXTASY, a tranſport which ſuſpends the function of the ſenſes, by the intenſe contemplation of ſome extraordinary or ſupernatural object.

EXTASY, in *Medicine*, a ſpecies of catalepſy, when a perſon perfectly remembers, after the paroxyſm is over, the ideas he conceived during the time it laſted.

EXTENSION, in *Philoſophy*, one of the common and eſſential properties of body; or that by which it poſſeſſes or takes up ſome part of univerſal ſpace, which is called the place of that body. See METAPHYSICS.

EXTENSOR, an appellation given to ſeveral muſcles,

Extent || Extortion.

muſcles, from their extending or ſtretching the parts to which they belong. See ANATOMY, *Table of the Muſcles*.

EXTENT, in *Law*, is uſed in a double ſenſe. Sometimes it ſignifies a writ or command to the ſheriff for the valuing of lands or tenements; and ſometimes the act of the ſheriff, or other commiſſioner, upon this writ.

Old and New EXTENT, in *Scots Law*. See LAW *Index*.

EXTENUATION, the act of diminiſhing or leſſening the bulk or ſubſtance of a thing, eſpecially of the human body. Fevers, agues, long abſtinences, &c. occaſion great extenuations or emaciations.

EXTENUATION, is alſo a figure in rhetoric, oppoſite to the hyperbole. The Greeks call it ἀλόλωσις.

EXTERIOR, or EXTERNAL. See EXTERNAL.

EXTERMINATION, in general, the extirpating or deſtroying ſomething.

EXTERMINATION or EXTERMINATING, in *Algebra*, is uſed for taking away. Thus algebraiſts ſpeak of exterminating ſurds, fractions, and unknown quantities out of equations. See Maclaur. Algebr. Part I. Chap. 12. where we have ſome general theorems for the exterminating unknown quantities in given equations.

EXTERNAL, a term of relation applied to the ſurface or outſide of a body, or that part which appears or preſents itſelf to the eye, touch, &c. in contradiſtinction to internal.

EXTERNAL is alſo uſed to ſignify any thing that is without ſide a man, or that is not within himſelf, particularly in his mind; in which ſenſe we ſay, external objects, &c.

EXTINCTION, in general, denotes the putting out or deſtroying ſomething, as a fire or flame. See *Extinguiſhing of* FIRE.

EXTINGUISHMENT, in *Law*, is a conſolidation or union, as where one has due to him a yearly rent out of lands, and afterwards purchaſes the lands out of which the rent ariſes; in this caſe, both the property and the rent being united in one poſſeſſor, the rent is ſaid to be extinguiſhed.

EXTIRPATION, (formed of *ex* and *ſtirps*, "root,") the act of pulling up or deſtroying a thing to the very roots. Among the prayers of the Romiſh jubilee, there is one for the extirpation of hereſy.

EXTIRPATION is alſo uſed, in *Surgery*, for cutting off any part entirely; as a wen, &c. or the eating it away, as a wart, &c. by corroſive medicines.

EXTISPEX, in antiquity, the perſon who drew preſages from viewing the entrails of animals offered in ſacrifice.

EXTORTION, in *Law*, is an illegal manner of wreſting any thing from a man, either by force, menace, or authority. It is alſo the exaction of unlawful uſury, winning by unlawful games, and taking more than is due under pretence of right, as exceſſive tolls in millers, &c.

At the common law, extortion is puniſhable by fine and impriſonment; and the ſtatute of 3 Eliz. 1. c. 30. has enacted, that officers of juſtice guilty of extortion for the expedition of buſineſs, &c. ſhall render to the party treble value. There are likewiſe divers other ſtatutes for puniſhing extortions of ſheriffs, bailiffs, gaolers, clerks of the aſſize and of the peace, attorneys, ſolicitors, &c.

Extract || Extravaſation.

EXTRACT, in *Pharmacy*, is a ſolution of the purer parts of a mixed body inſpiſſated, by diſtillation or evaporation, nearly to the conſiſtence of honey.

EXTRACT, in matters of literature, is ſomething copied or collected from a book or paper.

EXTRACTION, in *Chemiſtry* and *Pharmacy*, the operation by which eſſences, tinctures, &c. are drawn from natural bodies.

EXTRACTION, in *Surgery*, is the drawing any foreign matter out of the body by the hand, or by the help of inſtruments. See SURGERY.

EXTRACTION, in genealogy, implies the ſtock or family from which a perſon is deſcended. See DESCENT.

Extraction of Roots, in *Algebra* and *Arithmetic*, the methods of finding the roots of given numbers or quantities. See ALGEBRA and ARITHMETIC.

EXTRACTOR, in *Midwifery*, an inſtrument or forceps for extracting children by the head.

EXTRAJUDICIAL, ſomething done out of the proper court, or the ordinary courſe of law. As when judgment is given in a cauſe, or caſe, not depending in in that court where ſuch judgment is given, or wherein the judge has no juriſdiction.

EXTRAORDINARII, amongſt the Romans, was a body of men conſiſting of a third part of the foreign horſe and a fifth of the foot, which was ſeparated from the reſt of the forces borrowed from the confederate ſtates with great policy and caution, to prevent any deſign that they might poſſibly entertain againſt the natural forces. A more choice body of men were drawn from among the extraordinarii under the name of *ablecti*. See ABLECTI.

EXTRAORDINARY, ſomething out of the common courſe.

Extraordinary Couriers, are thoſe ſent expreſs on ſome urgent occaſion.

Extraordinary Ambaſſador, or envoy, is ſuch a one as is ſent to treat or negotiate ſome ſpecial and important affair, as a marriage, a treaty, confederacy, &c. or even on occaſion of ſome ceremony, as condolence, congratulation, &c.

A gazette, journal, or other newſpaper extraordinary, is that publiſhed after ſome great and notable event, containing the detail or particulars thereof, which are not found in the ordinary papers.

EXTRAVAGANTES, thoſe decretal epiſtles which were publiſhed after the CLEMENTINES.

They were ſo called, becauſe at firſt they were not digeſted or ranged with the other papal conſtitutions, but ſeemed to be, as it were, detached from the canon law. They continued to be called by the ſame name when they were afterwards inſerted in the body of the canon law. The firſt extravagantes are thoſe of John XXII. ſucceſſor of Clement V. The laſt collection was brought down to the year 1483, and was called the *common extravagantes*, notwithſtanding that they were likewiſe incorporated with the reſt of the canon law.

EXTRAVASATION, in contuſions, fiſſures, depreſſions, fractures, and other accidents of the cranium, is when one or more of the blood-veſſels, that are diſtributed

Extreme || Exuviæ.

ſtributed in the dura mater, is broken or divided, whereby there is ſuch a diſcharge of blood as greatly oppreſſes the brain, and diſturbs its office; frequently bringing on violent pains and other miſchiefs; and at length death itſelf, unleſs the patient is timely relieved. See SURGERY and MEDICINE *Index*.

EXTREME, is applied to the laſt and outermoſt part of any thing; or that which finiſhes and terminates it on that ſide.

EXTREMES, in *Logic*, denote the two extreme terms of the concluſion of a ſyllogiſm; viz. the predicate and ſubject. They are called *extremes*, from their relation to another term, which is a medium or mean between them. The predicate, as being likewiſe had in the firſt propoſition, is called the *majus extremum*, greater extreme; and the ſubject, as being put in the ſecond or minor propoſition, is called the *minus extremum*, leſſer extreme. Thus, in the ſyllogiſm, man is an animal; Peter is a man, therefore Peter is an animal; the word animal is the greater extreme, Peter the leſs extreme, and man the medium. See SYLLOGISM.

EXTREME and mean proportion, in *Geometry*, is when a line is ſo divided, that the whole line is to the greater ſegment, as that ſegment is to the other: Or, as it is expreſſed by Euclid, when the line is ſo divided, that the rectangle under the whole line, and the leſſer ſegment, is equal to the ſquare of the greater ſegment.

EXTREME Unction. See UNCTION.

EXTREMITIES of figures, in *Painting*, is uſed for the head, hands, and feet. Theſe ſhould be drawn with more nicety and exactneſs, or more terminated than other parts; and thus help to render the action more expreſſive.

EXTRINSIC, among metaphyſicians, is taken in various ſenſes. Sometimes it ſignifies a thing's not belonging to the eſſence of another; in which ſenſe, the efficient cauſe and end of a thing are ſaid to be extrinſic. Sometimes it ſignifies a thing's not being contained within the capacity of another; in which ſenſe, thoſe cauſes are called extrinſic which introduce ſomething into a ſubject from without, as when a fire introduces heat. Sometimes it ſignifies a thing added or applied to another; in which ſenſe accidents and adherents are ſaid to be extrinſic to the ſubjects to which they adhere. Sometimes the viſion is ſaid to be extrinſic from ſome form which does not exiſt in that thing, but is adjacent to it, or by ſome means or other without it.

EXTUBERANCES, in *Medicine*, are ſwellings or riſings up in the fleſh or other parts of the body.

EXUBERANCE, (compounded of *ex* and *uber*, "plentiful;") in *Rhetoric*, a redundancy. See REDUNDANCE and PLEONASM.

EXUDATION. See EXSUDATION.

EXVERRÆ, in antiqnity, a kind of bruſh uſed in cleanſing houſes out of which a dead perſon had been carried.

EXULCERATION, in *Medicine*, the act of cauſing or producing ulcers. Thus, arſenic exulcerates the inteſtines; corroſive humours exulcerate the ſkin.

EXULCERATION is ſometimes alſo uſed for an ulcer itſelf; but more generally for thoſe beginning croſions which wear away the ſubſtance, and form ulcers.

EXUVIÆ, among naturaliſts, denote the caſt off parts or coverings of animals, as the ſkins of ſerpents, caterpillars, and other inſects.

Exuviæ || Eymouth.

EXUVIÆ is alſo uſed for ſome ſhells and other marine bodies, frequently found in the bowels of the earth; ſuppoſed to have been depoſited there at the deluge, as being the real ſpoils of once living creatures. See DELUGE, CONCHOLOGY, and GEOLOGY.

EY, in our old writers, the ſame with *inſula*, "an iſland;" from which comes *eyet*, a ſmall iſland or iſlet, vulgarly called *eyght*.

EYCK. See BRUGES, *John of*.

EYE, in *Anatomy*. See ANATOMY *Index*.

A new born child ſhall be obſerved, perhaps, never to keep its eyes fixed on any one object, but continually changing from one to another, and if you put your hand before them, the child will not wink. Hence ſome have thought, that new-born infants have no ſight: but this is a miſtake; and the true reaſon why their eyes are in perpetual motion is, that they have not yet acquired the habit of examining one thing at once with their eyes: their not winking at the approach of the hand, ariſes from their want of experience how eaſily their eyes may be hurt; but in a few days they get the habit of winking, ſo that afterwards their eyes do it ſpontaneouſly at the approach of danger.

Artificial eyes are made of concave plates of gold, ſilver, or glaſs, and are ſtained ſo as to reſemble the natural eye. They muſt, when fixed in the orbit, be taken out and cleaned every night, and replaced in the morning. If no more of a diſeaſed eye is removed than what is preternaturally projected, or if enough is left to preſerve the muſcles unhurt, the artificial eye will have a little motion from the muſcles that remain. If the eye does not fit well, it irritates and inflames the other eye; in which caſe lay it aſide, until one can be had that fits better.

Bull's EYE, in *Aſtronomy*. See ALDEBARAN.

EYE of a Block, in naval affairs, that part of the rope-ſtrop which is faſtened to ſome neceſſary place in the ſhip: the ſtrop is a ſort of wreath or rope formed into a ring, and fixed round the block for the double convenience of ſtrengthening the block and faſtening it in any place where it is wanted.

EYE, in *Agriculture* and *Gardening*, ſignifies a little bud or ſhoot, inſerted into a tree by way of graft. See ENGRAFTING.

EYE of a Tree, a ſmall pointed knot to which the leaves ſtick, and from which the ſhoots or ſprigs proceed. See GEMMA.

EYE, a town of Suffolk, 22 miles from Ipſwich and 91 from London. It may be called an iſland, becauſe it is ſurrounded by a brook near the borders of Norfolk, in the road between Ipſwich and Norwich. It was incorporated by King John; has two bailiffs, 10 principal burgeſſes, 24 common council, a recorder, and town clerk. It is a mean-built place, with narrow ſtreets. The chief manufacture is bone-lace and ſpinning. Here is, however, a large handſome church; and near it are the ruinous walls of an ancient caſtle and monaſtery. The market is on Saturday, the fair on Whit-Monday. It has only ſent members to parliament ſince the reign of Edward IV.

EYE-Bright. See EUPHRASIA, BOTANY *Index*.

EYMOUTH, a town of Scotland in the county of Berwick, formerly fortified to curb the garriſon of Ber-

Eyrac || Ezekiel.

wick, from which place it is diſtant ſix miles. W. Long. 1. 50. N. Lat. 55. 50. It gave title of baron in the kingdom of Scotland to Churchill, afterwards the great duke of Marlborough; but he having no male iſſue, it became extinct in him.

EYRAC, or IRAC, ARABIA, a province of Turkey in Aſia, 345 miles in length, and 190 in breadth; of which Bagdad is the capital.

EYRAC Agemi, the principal province of Perſia, anciently called *Parthia*.

EYRE, or EIRE, in *Law*, the court of itinerant juſtices. See ASSISE.

EYRIE, in *Falconry*, a brood or neſt, a place where hawks build and hatch their young.

EZEKIEL, a canonical book of the Old Teſtament, referring chiefly to the degenerate manners and corruptions of the Jews of thoſe times. It abounds with fine ſentences and rich compariſons, and diſcovers a good deal of learning in profane matters.

Ezekiel was carried captive to Babylon with Jehoiachin, and began his prophecies in the fifth year of the captivity. He was cotemporary with Jeremiah, who propheſied at the ſame time in Judea. He foretold many events, particularly the deſtruction of the temple, the fatal cataſtrophe of thoſe who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

Ezion-gaber, Ezra.

EZION-GABER. See ASIONGABER.

EZRA, a canonical book of the Old Teſtament; comprehending the hiſtory of the Jews from the time of Cyrus's edict for their return, to the 20th year of Artaxerxes Longimanus. It ſpecifies the number of Jews who returned, and Cyrus's proclamation for the rebuilding the temple, together with the laying its foundation, the obſtruction it met with, and the finiſhing thereof in the reign of Darius.

The illuſtrious author of this book was alſo the reſtorer and publiſher of the canon of the Old Teſtament. See BIBLE.

The books of Ezra, called in the Engliſh verſion the *Firſt and Second Book of Eſdras*, though held by ſome, particularly the Greeks, for canonical, are thrown by the Engliſh church into the number of apocryphal books, being only extant in Greek.

F.

F.

F, THE fourth conſonant, and ſixth letter of the alphabet. The letter F is borrowed from the digamma or double gamma of the Æolians, as is evident from the inſcription on the pedeſtal of the Coloſſus at Delos; and was undoubtedly formed from the old Hebrew vau: and though this letter is not found in the modern Greek alphabet, yet it was in the ancient one, from whence the Latins received it and tranſmitted it to us.

It is formed by a ſtrong expreſſion of the breath, and joining at the ſame time the upper teeth and under lip. It has but one ſort of ſound, which has a great affinity with *v* and *ph*, the letter being written for it by us in all Greek words, as *philoſophy*, &c. though the Italians write it *filoſofia*.

The Romans for ſome time uſed an inverted F, Ⅎ, inſtead of V conſonant, which had no peculiar figure in their alphabet. Thus, in inſcriptions we meet with TERMINAⅎIT, DIⅎI, &c. Lipſius and others ſay, that it was the emperor Claudius who introduced the uſe of the inverted digamma, or Ⅎ: but it did not long ſubſiſt after his death; for Quintilian obſerves, that it was not uſed in his time.

F, or FA, in *Muſic*, is the fourth note in riſing in this order of the gamut, *ut*, *re*, *mi*, *fa*. It likewiſe denotes one of the Greek keys in muſic, deſtined for the baſs.

F, in phyſical preſcription ſtands for *Fiat*, or "Let it be done." Thus *f. s. a.* ſignifies *fiat ſecundum artem*.

F, was alſo a numeral letter ſignifying 40; according to the verſe,

Sexta quaterdenos gerit quæ diſtat ab alpha.

Faba || Fabii.

And when a daſh was added at top, thus F̄, it ſignified forty thouſand.

F, in the civil law. Two f's joined together thus, *ff*, ſignify the Pandects. See PANDECTS.

F, in the civil law, a ſtigma or brand put upon felons with a hot iron, on their being admitted to the benefit of clergy; by ſtat. 4 Hen. VII. c. 13.

FABA. See VICIA, BOTANY *Index*.

FABAGO, a ſpecies of bean-caper. See ZYGOPHYLLUM, BOTANY *Index*.

FABER. See ZEUS, ICHTHYOLOGY *Index*.

FABIAN, ROBERT, an alderman of the city of London, and ſheriff in the year 1494; was a perſon of learning for the time he lived in, a good poet, and author of a Chronicle of England and France, entitled *The Concordance of Stories*, in two volumes folio, beginning with Brute, and ending with the 20th of Henry VII. 1504. It contains ſeveral curious particulars relative to the city of London, not elſewhere to be found. Stow calls it "a painful labour, to the great honour of the city and of the whole realm": We are told that Cardinal Wolſey cauſed as many copies of this book as he could procure to be burned, becauſe the author had made too clear a diſcovery of the large revenues of the clergy. Fabian died in 1512.

FABII, a noble and powerful family at Rome, who derived their name from *faba*, a bean, becauſe ſome of their anceſtors cultivated this pulſe. They were once ſo numerous that they took upon themſelves to wage

a

Fabius. a war againſt the Veientes. They came to a general engagement near the Cremera, in which all the family conſiſting of 306 men, were totally ſlain, in the year of Rome 277. There only remained one whoſe tender age had detained him at Rome, and from him aroſe the noble Fabii in the following ages.

FABIUS, MAXIMUS RULLIANUS, was firſt of the Fabii who obtained the ſurname of *Maximus*, for leſſening the power of the populace at elections. He was maſter of horſe: and his victory over the Samnites in that capacity nearly coſt him his life, becauſe he engaged the enemy without the command of the dictator. He was five times conſul, twice dictator, and once cenſor. He triumphed over ſeven different nations in the neighbourhood of Rome, and rendered himſelf illuſtrious by his patriotiſm.

FABIUS *Ruſticus*, an hiſtorian in the age of Claudius and Nero. He was intimate with Seneca; and the encomiums which Tacitus paſſes upon his ſtyle, make us regret the loſs of his compoſitions.

Q. FABIUS *Maximus*, a celebrated Roman, who from a dull and inactive childhood was raiſed to the higheſt offices of the ſtate. In his firſt conſulſhip he obtained a victory over Liguria; and the fatal battle of Thraſymenus occaſioned his election to the dictatorſhip. In this important office he began to oppoſe Hannibal, not by fighting him in the open field, like his predeceſſors, but he continually haraſſed his army by countermarches and ambuſcades, from which he received the ſurname of *Cunctator* or *Delayer*. Hannibal ſent him word, "That if he was as great a captain as he would be thought, he ought to come into the plain and give him battle." But Fabius coldly replied, "That if he was as great a captain as he would be thought, he would do well to force him to fight." Such operations for the commander of the Roman armies gave offence to ſome; and Fabius was even accuſed of cowardice. He, however, continued firm in his firſt reſolutions; and patiently bore to ſee his maſter of horſe raiſed to ſhare the dictatorial dignity with himſelf by means of his enemies at home. When he had laid down his office of dictator, his ſucceſſors for a while followed his plan; but the raſhneſs of Varro, and his contempt for the operations of Fabius, occaſioned the fatal battle of Cannæ. Tarentum was obliged to ſurrender to his arms after the battle of Cannæ; and on that occaſion the Carthaginian army obſerved that Fabius was the Hannibal of Rome. When he had made an agreement with Hannibal for the ranſom of the captives, which was totally diſapproved by the Roman ſenate, he ſold all his eſtates to pay the money, rather than forfeit his word to the enemy. The bold propoſal of young Scipio to go and carry the war from Italy to Africa, was rejected by Fabius as chimerical and dangerous. He did not, however, live to ſee the ſucceſs of the Roman arms under Scipio, and the conqueſt of Carthage by meaſures which he treated with contempt and heard with indignation. He died in the 100th year of his age, after he had been five times conſul, and twice honoured with a triumph. The Romans were ſo ſenſible of his great merit and ſervices, that the expences of his funeral were defrayed from the public treaſury. His ſon bore the ſame name, and ſhowed himſelf worthy of his noble father's virtues. During his conſulſhip he received a viſit from his father on horſeback in the camp. The ſon ordered his father to diſmount; and the old man cheerfully obeyed, embracing his ſon, and ſaying, "I wiſhed to know whether you knew what it is to be conſul." He died before his father, and Cunctator with the moderation of a philoſopher delivered a funeral oration over the dead body of his ſon. Fabius || Fabriano.

FABIUS, ſtyled *Pictor*, a Roman general and hiſtorian. He firſt introduced painting at Rome; and having cauſed the walls of the temple of Health to be painted, ſome authors have erroneouſly reckoned him a painter. He died about 216 B. C.

FABLE, a tale, or feigned narration, deſigned either to inſtruct or divert, diſguiſed under the allegory of an action, &c.

Fables were the firſt pieces of wit that made their appearance in the world; and have continued to be highly valued, not only in times of the greateſt ſimplicity, but in the moſt polite ages of the world. Jotham's fable of the trees is the oldeſt that is extant, and as beautiful as any that have been made ſince. Nathan's fable of the poor man is next in antiquity. We find Æſop in the moſt diſtant ages of Greece; and in the early days of the Roman commonwealth, we read of a mutiny appeaſed by the fable of the belly and the members. As fables had their riſe in the very infancy of learning, they never flouriſhed more than when learning was at its greateſt height; witneſs Horace, Boileau, and Fontaine.

Fable is the fineſt way of giving counſel, and moſt univerſally pleaſing, becauſe leaſt ſhocking; for, in the reading of a fable, a man thinks he is directing himſelf, whilſt he is following the dictates of another, and conſequently is not ſenſible of that which is the moſt unpleaſing circumſtance in advice. Beſides, the mind is never ſo much pleaſed as when ſhe exerts herſelf in any action that gives her an idea of her own abilities; this natural pride of the ſoul is very much gratified in the reading of fable.

FABLE, is alſo uſed for the plot of an epic or dramatic poem; and is, according to Ariſtotle, the principal part, and, as it were, the ſoul of the poem. See POETRY.

FABRI, HONORIUS, a laborious Jeſuit born in the dioceſe of Bellay, diſtinguiſhed himſelf by his ſkill in philoſophy and the mathematics, and by writing a great number of books; the moſt curious of which treat of geometry, optics, the loadſtone, the motion of the earth, the ebbing and flowing of the ſea, &c. He died at Rome in 1688.

FABRIANO, GENTILE DA, painter of hiſtory, was born at Verona in 1332, and became a diſciple of Giovanni da Fieſole. In that early age of painting he rendered himſelf very famous, and was employed to adorn a great number of churches and palaces at Florence, Urbino, Siena, Peruſia, and Rome, but particularly in the Vatican; and one picture of his, repreſenting the Virgin and Child, attended by Joſeph, which is preſerved in the church of S. Maria Maggiore, was highly commended by Michael Angelo. By order of the doge and ſenate of Venice, he painted a picture in the great council chamber, which was conſidered as ſo extraordinary a performance, that his employers granted him a penſion for life, and conferred on him the higheſt honour of their ſtate, which was, the

Fabric, Fabricius.

privilege of wearing the habit of a noble Venetian. He died in 1412.

FABRIC, in general, denotes the ſtructure or conſtruction of any thing; but particularly of buildings, as a church, hall, houſe, &c. See ARCHITECTURE.

Fabric Lands, thoſe formerly given towards rebuilding and repairing of cathedrals and other churches; for anciently almoſt every body gave more or leſs, by his will, to the fabric of the pariſh church where he dwelt.

FABRICIUS, C. a celebrated Roman, who in his firſt conſulſhip, year of Rome 470, obtained ſeveral victories over the Samnites and Lucanians, and was honoured with a triumph. The riches which were acquired in thoſe battles were immenſe, the ſoldiers were liberally rewarded by the conſul, and the treaſury was enriched with 400 talents. Two years after, Fabricius went as ambaſſador to Pyrrhus, and refuſed with contempt preſents, and heard with indignation offers, which might have corrupted the fidelity of a leſs virtuous citizen. Pyrrhus had occaſion to admire the magnanimity of Fabricius; but his aſtoniſhment was more powerfully awakened when he ſaw him make a diſcovery of the perfidious offers of his phyſician, who pledged himſelf to the Roman general for a ſum of money to poiſon his royal maſter. To this greatneſs of ſoul was added the moſt conſummate knowledge of military affairs, and the greateſt ſimplicity of manners. Fabricius never uſed rich plate at his table. A ſmall ſalt-cellar, the feet of which were of horn, was the only ſilver veſſel which appeared in his houſe. This contempt of luxury and uſeleſs ornaments Fabricius wiſhed to inſpire among the people; and during his cenſorſhip he baniſhed from the ſenate Cornelius Ruffinus, who had been twice conſul and dictator, becauſe he kept in his houſe more than ten pounds weight of ſilver plate. Such were the manners of the conqueror of Pyrrhus, who obſerved that he wiſhed rather to command thoſe that had money, than poſſeſs it himſelf. He lived and died in the greateſt poverty. His body was buried at the public charge, and the Roman people were obliged to give a dowry to his two daughters when they had arrived at years of maturity.

FABRICIUS, *George*, a learned German, born at Chemnitz in Miſnia, in 1516. After a liberal education, he viſited Italy in quality of tutor to a young nobleman; and, examining all the remains of antiquity with great accuracy, compared them with their deſcriptions in Latin writers. The reſult of theſe obſervations was his work entitled *Roma*, containing a deſcription of that city. He afterwards ſettled at Miſenum, where he conducted a great ſchool to the time of his death in 1571. He was alſo the author of a great number of ſacred Latin poems, wrote ſeven books of the *Annals of Miſnia*, three of the *Annals of Meiſſen*, and *Travels*.

FABRICIUS, *Jerom*, a celebrated phyſician in the latter end of the 16th century (ſurnamed *Aquapendente*, from the place of his birth), was the diſciple and ſucceſſor of Fallopius. He chiefly applied himſelf to ſurgery and anatomy, which he profeſſed at Padua for 40 years with extraordinary reputation. The republic of Venice ſettled a large penſion upon him, and honoured him with a gold chain and a ſtatue. He died in 1603; leaving behind him ſeveral works which are much eſteemed.

Fabricius || Face.

FABRICIUS, *John Albert*, one of the moſt learned and laborious men of his age, was born at Leipſic in 1668. He was choſen profeſſor of eloquence at Hamburgh in 1699, and was made doctor of divinity at Kiel. His works are numerous; and he died at Hamburgh in 1736, after a life ſpent in the ſevereſt literary application to collect and publiſh valuable remains of ancient learning.

FABRICIUS, *Vincent*, born at Hamburgh in 1613, was a good poet, a great orator, an able phyſician, and a learned civilian. He was for ſome time counſellor to the biſhop of Lubec, and afterward burgomaſter and ſyndic of the city of Dantzic; from whence he was 13 times ſent deputy into Poland, where he died at Warſaw in 1657, during the diet of that kingdom. The moſt complete edition of Fabricius's poems and other works was publiſhed at Leipſic in 1685, under the direction of his ſon Frederic Fabricius.

FABRICIUS, *Baron*, one of the fineſt gentlemen of his time, and known to the public by his letters relating to the tranſactions of Charles XII. of Sweden during his reſidence in the Ottoman empire, was deſcended from a good family in Germany. He was taken early into the ſervice of the court of Holſtein; and was ſent in a public character to the king of Sweden whilſt he was at Bender; where he ſoon acquired the good graces of that prince. He accompanied him in his exerciſes; gave him a turn for reading; and it was out of his hand Charles ſnatched Boileau's ſatires, when he tore out thoſe that repreſented Alexander the Great as a madman. Fabricius was alſo in favour with Staniſlaus, and with our King George I. whom he accompanied in his laſt journey to Hanover, and was with him when he died. A tranſlation of his letters was publiſhed in London 1761.

FABROT, CHARLES HANNIBAL, one of the moſt celebrated civilians of his time, was born at Aix in 1681; and acquired an extraordinary ſkill in the civil and canon law, and in the belles lettres. He publiſhed the *Baſilicæ*, or Conſtitutions of the Emperors of the Eaſt, in Greek and Latin, with learned notes, in ſeven vols. folio; and editions of *Cedrenus*, *Nicetas*, *Anaſtaſius Bibliothecarius*, *Conſtantine Manaſſes*, and *Cujas*, with learned and curious notes.

FABULOUS, ſomething conſiſting of, or connected with, a fable.

Fabulous Age, among ancient hiſtorians. See AGE.

FACE, the ſurface, or firſt ſide which a body preſents to the eye. We ſay, the *face* of the earth, of the waters, &c. Polyhedrons have ſeveral *faces*. A die, or cube, has ſix *faces*.

FACE, is particularly uſed for the viſage of an animal, and eſpecially of man; and comprehends, in the latter, all that part of the head which is not covered with the common long hair. The Latins call it *facies*, *vultus*, *os*, &c.

The human face is called the *image of the ſoul*, as being the ſeat of the principal organs of ſenſe; and the place where the ideas, emotions, &c. of the ſoul are chiefly ſet to view. Pride and diſdain are ſhown in the eyebrows, modeſty on the cheeks, majeſty in the forehead,

Face || Factor.

head, &c. It is the face ſhews the ſex, age, temperament, health, or diſeaſe, &c.

The face, conſidered as the index of the paſſions, habits, &c. of the perſon, makes the ſubject of phyſiognomy. See PHYSIOGNOMY.

FACE, among painters and artiſts, is uſed to denote a certain dimenſion of the human body, adopted for determining the proportion which the ſeveral parts ſhould bear to one another. See DRAWING.

FACE, in the military art, a word of command, intimating to turn about: thus, *face to the right*, is to turn upon the left heel a quarter-round to the right; and, *face to the left*, is to turn upon the right heel a quarter-round to the left.

FACIES HIPPOCRATICA, in *Medicine*, is when the noſtrils are ſharp, the eyes hollow, the temples low, the tips of the ears contracted and cold, the forehead dry and wrinkled, and the complexion pale or livid.—The Hippocratic face is chiefly obſerved towards the period of phthiſes and other conſumptions, and is held a ſure prognoſtic of death. If it appears within three days after the attack of an acute diſeaſe, it is deemed to indicate death.

FACTION, a cabal or party formed in a ſtate, city, or company.

FACTION, in antiquity, a name given to the different companies of combatants in the circus. They were four, viz. the white, the red, the green, and the blue; to which Domitian added another of purple colour. They were ſo denominated from the colour of the liveries they wore; and were dedicated, according to M. Aur. Caſſiodorus, to the four ſeaſons of the year; the green being conſecrated to ſpring, the blue to winter, the red to ſummer, and the white to autumn. It appears from ancient inſcriptions, that each faction had its procurators and phyſician; and from hiſtory, that party rage ran ſo high among them, that in a diſſenſion between two factions, in the time of Juſtinian, almoſt 40,000 men loſt their lives in the quarrel.

FACTITIOUS, any thing made by art, in oppoſition to what is the produce of nature. Thus, factitious cinnabar is oppoſed to native cinnabar.

FACTOR, in commerce, is an agent employed by merchants reſiding at other places, to buy or ſell goods, or negotiate bills, or tranſact any kind of buſineſs on their account; and entitled to a certain allowance for his trouble.

A ſupercargo differs from a factor in this: The buſineſs of the former is limited to the care of a particular cargo; he goes along with it, and generally returns when his buſineſs is completed: the latter has a fixed reſidence abroad, and executes buſineſs for different merchants. But their duties, and the circumſtances for which they are accountable, are the ſame.

The duty of a factor is to procure the beſt intelligence of the ſtate of trade at his place of reſidence: of the courſe of exchange; of the quantity and quality of goods at market, their preſent price, and the probability that it may riſe or fall: to pay exact obedience to the orders of his employers; to conſult their advantage in matters referred to his direction; to execute their buſineſs with all the deſpatch that circumſtances admit; to be early in his intelligence, diſtinct in his accounts, and punctual in his correſpondence.

A factor's power is either abſolute or limited. Tho' intruſted with ample diſcretionary powers, he is not warranted to take unreaſonable or unuſual meaſures, or do any thing contrary to his employer's intereſt; but it is incumbent on the employer, if he challenge his proceedings, to prove that he could have done better, and was guilty of wilful miſmanagement. Factor.

When a factor's power is limited, he muſt adhere ſtrictly to his orders. If he exceeds his power, though with a view to his employer's intereſt, he is liable for the conſequence. For example, if he gives credit when not empowered, or longer credit if not empowered, for the ſake of a better price, and the buyer proves inſolvent, he is liable for the debt. A factor has no power to give credit unleſs authorized: But if the goods conſigned be generally ſold on credit at the place of conſignation, the factor will be vindicated for ſelling at the uſual credit, unleſs expreſsly reſtricted.

Although opinion will never juſtify the factor for departing from orders, neceſſity ſometimes will. If he be limited not to ſell goods under a certain price, and the goods be periſhable, and not in a ſituation for being kept, he may ſell them, to prevent their deſtruction, even under the price limited.

A factor is never warranted to deal on truſt, except with perſons in good credit at the time. If the employer challenge the debtors, it is incumbent on him to prove that their bad circumſtances were known at the time of ſale; and the factor will be vindicated, if he truſted them at the ſame time for goods of his own.

If the factor ſells his employer's goods on truſt, and, after the day of payment is elapſed, receive payment from the purchaſer for a debt of his own, he becomes liable in equity for the debt.

In caſe of bankruptcy, the factor ought immediately to lay attachments, and adviſe his employers; and he cannot withdraw his attachments, nor compound debts, without orders.

If a factor ſells goods belonging to different merchants to the ſame perſon, and the buyer proves inſolvent, they ſhall bear the loſs in equal proportions; and, if the buyer has paid part before his inſolvency, without ſpecifying for which, the payment ought to be diſtributed in equal proportions; but, if the days of payment be fixed, and part of the debts only due, the payment ought to be applied, in the firſt place, to ſuch debts as were due.

If he makes a wrong entry at the cuſtom-houſe, and the goods be ſeized in conſequence thereof, he muſt bear the loſs, unleſs the error be occaſioned by a miſtake in the invoice, or letter of advice.

The owner bears the loſs of goods ſeized when attempted to be ſmuggled by his orders; but the factor complying with an unlawful order is liable in ſuch penalties as the laws exact.

If a factor ſaves the duty of goods due to a foreign prince, he ſhall have the benefit; for, if detected, he bears the loſs.

If a factor ſells goods bought by his employer's orders for his own advantage, the employer may recover the benefit, and the factor ſhall be amerced for the ſame.

If a factor receives bad money in payment, he bears the loſs; but if the value of the money be leſſened by the government, the employer bears the loſs.

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Factor Faculty.

A factor is not liable for goods ſpoiled, robbed, or deſtroyed by fire.

If a factor receives counterfeit jewels from his employer, and ſells them, the employer is liable to indemnify him for any penalties he may incur.

If a factor be ordered to make inſurance, and neglect it, and the ſubject be loſt, he is liable to make it good, providing he had effects in his hands.

If a factor buys goods for his employer, his bargain ſhall be binding on the employer.

In caſe of a factor's inſolvency, the owner may reclaim his goods; and, if they be ſold on truſt, the owner (and not the factor's creditors) ſhall recover payment of the debts.

FACTOR, in multiplication, a name given to the multiplier and multiplicand, becauſe they conſtitute the product. See ARITHMETIC.

FACTORAGE, called alſo *commiſſion*, is the allowance given to factors by the merchant who employs them.

A factor's commiſſion in Britain, on moſt kinds of goods, is 2½ per cent.; on lead, and ſome other articles, 2 per cent.; in Italy, 2½ per cent.; in France, Holland, Spain, Portugal, Hamburgh, and Dantzic, 2 per cent: in Turkey, 3 per cent.; in North America, 5 per cent. on ſales, and 5 per cent. on returns; in the Weſt Indies, 8 per cent for commiſſion and ſtorage. In ſome places, it is cuſtomary for the factors to enſure the debts for an additional allowance, generally 1½ per cent. In that caſe, they are accountable for the debt when the uſual term of credit is expired.

Factorage on goods is ſometimes charged at a certain rate per caſk, or other package, meaſure, or weight, eſpecially when the factor is only employed to receive or deliver them.

FACTORY is a place where a conſiderable number of factors reſide, to negotiate for their maſters or employers. See FACTOR.

The moſt conſiderable factories belonging to the Britiſh are thoſe eſtabliſhed in the Eaſt Indies, Portugal, Turkey, &c. There are alſo Engliſh factories eſtabliſhed at Hamburgh, Peterſburgh, Dantzic, and in Holland; all endowed with certain privileges.

FACTUM, in *Arithmetic*, the product of two quantities multiplied by each other.

FACULÆ, in *Aſtronomy*, certain bright and ſhining parts, which the modern aſtronomers have, by means of teleſcopes, obſerved upon or about the ſurface of the ſun; they are but very ſeldom ſeen.—The word is pure Latin; being a diminutive of *fax*, "torch;" and ſuppoſed to be here applied from their appearing and diſappearing by turns.

FACULTY, in *Law*, a privilege granted to a perſon, by favour and indulgence, of doing what, by law, he ought not to do.

For granting theſe privileges, there is a court under the archbiſhop of Canterbury, called the *court of the faculties*. The chief officer of this court is ſtyled *maſter of the faculties*, and has a power of granting diſpenſations in divers caſes: as to marry without the bans being firſt publiſhed, to eat fleſh on days prohibited, to ordain a deacon under age, for a ſon to ſucceed his father in his benefice, a clerk to hold two or more livings, &c.

FACULTY, in the ſchools, a term applied to the different members of an univerſity, divided according to the arts and ſciences taught there: thus in moſt univerſities there are four faculties, viz. 1. Of arts, which include humanity and philoſophy. 2. Of theology. 3. Of phyſic. And, 4. Of civil law. Faculty || Page.

Faculty of Advocates. See ADVOCATES.

FACULTY is alſo uſed to denote the powers of the human mind, viz. underſtanding, will, memory, and imagination. See METAPHYSICS.

FÆCES, in *Chemiſtry*, the groſs matter, or ſediment, that ſettles at the bottom after diſtillation, fermentation, and the like.—The fæces of wine are commonly called LEES.

FÆCES, in *Medicine*, the excrements voided by ſtool. See EXCREMENTS.

FÆCULENT, in general, is applied to things abounding with fæces or dregs: thus the blood and other humours of the human body are ſaid to be fæculent, when without that purity which is neceſſary to health.

FAENSA, a city and biſhop's ſee of Italy, ſituated in the pope's territories, about 30 miles eaſt of Bologna: E. Long. 12. 38. and N. Lat. 44. 30.

FAENZA, a city of Romagna in Italy with a biſhop's ſee. It is an ancient place, and has undergone various revolutions. The river Amona waſhes its walls, and paſſes between the city and the ſuburbs, which are joined by a ſtone bridge defended by two good towers. The city is remarkable for its earthen ware, which is the beſt in all Italy.

FAERNUS, GABRIEL, a native of Cremona in Italy, was an excellent Latin poet and critic of the 16th century. He was ſo ſkilled in all parts of polite literature, that the cardinal de Medicis, afterward Pope Pius IV. was particularly fond of him. He was the author of ſome Latin elegies; of 100 Latin fables, ſelected from the ancients, written in iambic verſe; and of ſeveral pieces of criticiſm, as *Cenſura emendationum Livianarum*, *De Metris Comicis*, &c. He was remarkably happy in decyphering manuſcripts, and reſtoring ancient authors to their purity: he took ſuch pains with Terence in particular, that Bentley has adopted all his notes in the edition he gave of that writer. He died at Rome in 1561; and Thuanus, who wrote his eloge, ſays that the learned world was greatly obliged to him; yet had been ſtill more ſo, if, inſtead of ſuppreſſing the then unknown fables of Phædrus, for fear of leſſening the value of his own Latin fables, written in imitation of Æſop, he had been content with imitating them. M. Perrault, however, who tranſlated Faernus's fables into French, has defended him from this imputation, by affirming that the firſt MS. of Phædrus's fables, found in the duſt of an old library, was not diſcovered till about 30 years after Faernus's death.

FAGARA, IRON WOOD: a genus of plants belonging to the tetrandria claſs, and in the natural method ranking under the 43d order, *Dumoſæ*. See BOTANY *Index*.

FAGE, RAIMOND DE LA, an excellent deſigner and engraver, highly eſteemed by Carlo Maratti, was born at Toulouſe in 1648. He applied himſelf to deſigning, through inclination, in ſpite of his parents; and had no maſter nor any aſſiſtance: but his ſuperior talents ſupplied the want of them, and he became one of the beſt deſigners in Europe; his performances on licentious

Faggot ‖ Fagus.

centious ſubjects are the moſt eſteemed. It is reported of this artiſt, that he never made uſe of money, but contracted debts; and when the accounts were brought him, he made ſome deſign upon the back of the bills, and bid the owners ſell the drawings to connoiſſeurs for the amount, by which they were generally great gainers. Several of thoſe drawings are yet in the cabinets of the curious. He led a looſe, depraved life; and his repeated debaucheries put an end to it at the age of 42.

FAGGOT, in times of Popery here, was a badge worn on the ſleeve of the upper garment of ſuch perſons as had recanted or abjured what was then termed *hereſy*; being put on after the perſon had carried a faggot, by way of penance, to ſome appointed place of ſolemnity. The leaving off the wear of this badge was ſometimes interpreted a ſign of apoſtaſy.

FAGGOTS, among military men, perſons hired by officers, whoſe companies are not full, to muſter and hide the deficiencies of the company; by which means they cheat the king of ſo much money.

FAGIUS, PAUL, *alias* BUCHLIN, a learned Proteſtant miniſter, born at Rheinzabern in Germany in 1504. He was a ſchoolmaſter at Iſna; but afterwards became a zealous preacher, and wrote many books. The perſecution in Germany menacing danger to all who did not profeſs the Romiſh doctrines, he and Bucer came over to England in 1549, at the invitation of Archbiſhop Cranmer, to perfect a new tranſlation of the Scriptures. Fagius took the Old Teſtament, and Bucer the New, for their reſpective parts; but the deſign was at that time fruſtrated by the ſudden deaths of both. Fagius died in 1550, and Bucer did not live above a year after. Their bodies were dug up and burned in the reign of Queen Mary.

FAGONIA, a genus of plants belonging to the decandria claſs, and in the natural method ranking under the 14th order, *Gruinales*. See BOTANY *Index*.

FAGOPYRUM, or BUCK WHEAT. See POLYGONUM, BOTANY *Index*.

FAGUS, the BEECH TREE; a genus of plants belonging to the monœcia claſs, and in the natural method ranking under the 50th order, *Amentaceæ*. See BOTANY *Index*.

The *cheſnut tree*, one of the ſpecies belonging to this genus, ſometimes grows to an immenſe ſize. The largeſt in the known world are thoſe which grow upon Mount Ætna in Sicily. At Tortworth in Glouceſterſhire, is a cheſnut tree 52 feet round. It is proved to have ſtood there ever ſince the year 1150, and was then ſo remarkable that it was called the *great cheſnut of Tortworth*. It fixes the boundary of the manor, and is probably near 1000 years old. As an ornamental, the cheſnut, though unequal to the oak, the beech, and the eſculus, has a degree of greatneſs belonging to it which recommends it ſtrongly to the gardener's attention. Its uſes have been highly extolled; and it may deſerve a conſiderable ſhare of the praiſe which has been given it. As a ſubſtitute for the oak, it is preferable to the elm: For door-jambs, window-frames, and ſome other purpoſes of the houſe carpenter, it is nearly equal to oak itſelf; but it is very apt to be ſhakey, and there is a deceitful brittleneſs in it which renders it unſafe to be uſed as beams, or in any other ſituation where an uncertain load is required to be borne. It is univerſally allowed to be excellent for liquor caſks; as not being liable to ſhrink nor to change the colour of the liquor it contains: it is alſo ſtrongly recommended as an underwood for hop-poles, ſtakes, &c. Its fruit too is valuable, not only for ſwine and deer, but as a human food: Bread is ſaid to have been made of it. Upon the whole, the cheſnut, whether in the light of ornament or uſe, is undoubtedly an object of the planter's notice.

Faint ‖ Fair.

FAINT ACTION, in *Law*, a feigned action, or ſuch as, although the words of the writ are true, yet for certain cauſes, the plaintiff has no title to recover thereby.

FAINT Pleader, in *Law*, a covinous, falſe, or colluſory manner of pleading, to the deceit of a third perſon.

FAINTING. See LIPOTHYMIA.

FAINTS, in the diſtillery, the weak ſpirituous liquor that runs from the ſtill in rectifying the low wines after the proof-ſpirit is taken off.

FAINTS are alſo the laſt runnings of all diſtilled ſpirits. The clearing the worm of theſe is ſo eſſential a point in order to the obtaining a pure ſpirit by the ſubſequent diſtillation, that all others are fruitleſs without it.

FAIR, a greater kind of market, granted to a town, by privilege, for the more ſpeedy and commodious providing of ſuch things as the place ſtands in need of.

The word fair, is formed from the French *foire*, which ſignifies the ſame thing; and *foire* is by ſome derived from the Latin *forum*, "market;" by others from the Latin *feriæ*, becauſe anciently fairs were always held in the places where the wakes, or feaſts of the dedications of churches, called *feriæ*, were held. See FERIÆ.

It is incident to a fair, that perſons ſhall be free from being arreſted in it for any other debt or contract than what was contracted in the ſame; or, at leaſt, promiſed to be paid there. Theſe fairs are generally kept once or twice a-year: and, by ſtatute, they ſhall not be held longer than they ought by the lords thereof, on pain of their being ſeized into the king's hands, &c. Alſo proclamation is to be made, how long they are to continue; and no perſon ſhall ſell any goods after the time of the fair is ended, on forfeiture of double the value, one fourth to the proſecutor and the reſt to the king. There is a toll uſually paid in fairs on the ſale of things, and for ſtallage, picage, &c.

Fairs abroad are either free, or charged with toll and impoſt. The privileges of free fairs conſiſt chiefly, firſt, in that all traders, &c. whether natives or foreigners, are allowed to enter the kingdom, and are under the royal protection, exempt from duties, impoſitions, tolls, &c. Secondly, that merchants, in going or returning, cannot be moleſted or arreſted, or their goods ſtopped. They are eſtabliſhed by letters-patent from the prince. Fairs, particularly free fairs, make a very conſiderable article in the commerce of Europe, eſpecially that of the Mediterranean, and inland parts of Germany, &c.

The moſt celebrated fairs in Europe are thoſe, 1. Of Francfort, held twice a-year, in ſpring and autumn: the firſt commencing the Sunday before Palm-Sunday, and the other on the Sunday before the eighth of September. Each laſts 14 days, or two weeks; the firſt of which is called the *week of accep-*

tance,

Fair. *dance*, and the ſecond the *week of payment*. They are famous for the ſale of all kinds of commodities; but particularly for the immenſe quantity of curious books nowhere elſe to be found, and whence the bookſellers throughout all Europe uſed to furniſh themſelves. Before each fair, there is a catalogue of all the books to be ſold thereat, printed and diſperſed, to call together purchaſers: though the learned complain of divers unfair practices therein; as fictitious titles, names of books purely imaginary, &c. beſide great faults in the names of the authors, and the titles of the real books. —2. The fairs of Leipſic, which are held thrice a-year; one beginning on the firſt of January; another three weeks after Eaſter; and a third after Michaelmas. They hold 12 days a-piece; and are at leaſt as conſiderable as thoſe of Francfort. 3. The fairs of Novi, a little city in the Milaneſe, under the dominion of the republic of Genoa. There are four in the year, commencing on the ſecond of February, the ſecond of May, the firſt of Auguſt, and ſecond of September. Though the commodities bought and ſold here be very conſiderable; yet, what chiefly contributes to render them ſo famous, is the vaſt concourſe of the moſt conſiderable merchants and negotiants of the neighbouring kingdoms, for the tranſacting of affairs and ſettling accounts. 4. The fairs of Riga, whereof there are two in the year; one in May, and the other in September. They are much frequented by the Engliſh, Dutch, and French ſhips, as alſo from all parts of the Baltic. The beſt time for the ſale of goods at Riga is during the fairs. Since the building of the famous city of Peterſburgh, theſe fairs have ſuffered ſome diminution. 5. Fair of Archangel, during which all the trade foreigners have with that city is managed. It holds a month, or ſix weeks at moſt, commencing from the middle of Auguſt. The Muſcovite merchants attend here from all parts of that vaſt empire; and the Engliſh, Dutch, French, Swediſh, Daniſh, and other ſhips in the port of that city, on this occaſion, ordinarily amount to 300. But this is no free fair as the reſt are: The duties of exportation and importation are very ſtrictly paid, and on a very high footing. 6. The fair of St Germain, one of the ſuburbs of Paris, commencing on the third of February, and holding till Eaſter; though it is only free for the firſt 15 days. 7. The fairs of Lyons, which Monſ. du Cheſne, in his antiquity of cities, would inſinuate, from a paſſage in Strabo, were eſtabliſhed by the Romans; though it is certain, the fairs, as they now ſtand, are of a much later date. There are three in the year, each laſting 20 days, and free for ever. They begin on Eaſter Monday, the 26th of July, and the firſt of December. 8. Fair of Guibray, a ſuburb of the city of Falaiſe, in the Lower Normandy. It is ſaid to have been eſtabliſhed by our William the Conqueror, in conſideration of his being born at Falaiſe. It commences on the 16th of Auguſt; and holds 15 days free by charter, and longer by cuſtom. 9. Fair of Beaucaire, held partly in a city of that name, in Languedoc, and partly in the open country, under tents, &c. It commences on the 22d of July, and only holds for three days; yet it is the greateſt and moſt celebrated of all the fairs in that part of Europe, both for the concourſe of ſtrangers from all parts of the world, and for the traffic of all kinds of goods: the money returned in theſe three days amounting ſometimes to above ſix millions of livres. Fair.

The fairs of Porto-Bello, Vera Cruz, and the Havannah, are the moſt conſiderable of all thoſe in America. The two firſt laſt as long as the flota and galleons continue in thoſe ports; and the laſt is opened as ſoon as the flota or galleons arrive there upon their return for Spain; this being the place where the two fleets join. See FLOTA and GALLEONS.

The principal Britiſh fairs are, 1. Sturbridge fair, near Cambridge, by far the greateſt in Britain, and perhaps in the world. 2. Briſtol has two fairs, very near as great as that of Sturbridge. 3. Exeter. 4. Weſt Cheſter. 5. Edinburgh. 6. Wheyhill; and, 7. Burford fair; both for ſheep. 8. Pancras fair, in Staffordſhire, for ſaddle-horſes. 9. Bartholomew fair, at London, for lean and Welſh black cattle. 10. St Faith's, in Norfolk, for Scotch runts. 11. Yarmouth fiſhing fair for herrings; the only fiſhing fair in Great Britain. 12. Ipſwich butter fair. 13. Woodborough-hill, in Dorſetſhire, for weſt country manufactures, as kerſeys, druggits, &c. 14. Two cheeſe fairs at Chipping Norton: with innumerable other fairs, beſides weekly markets, for all ſorts of goods, as well our own as of foreign growth.

FAIR, in ſea-language, is uſed for the diſpoſition of the wind, when it is favourable to a ſhip's courſe, in oppoſition to that which is contrary or foul. The term *fair* is more comprehenſive than *large*, and includes about 16 or 18 points of the compaſs; whereas large is confined to the beam or quarter, that is, to a wind which croſſes the keel at right angles, or obliquely from the ſtern, but never to one right a-ſtern.

FAIR Iſle, a ſmall iſland lying between Orkney and Shetland, 10 or 12 leagues E. N. E. from the former; and ſeven, eight, or 10 leagues S. W. from the latter. It is three miles long, and ſcarcely half a mile broad, very craggy, with three high rocks which are viſible both from Orkney and Shetland. It contains a ſmall quantity of arable land, which is very fruitful and well manured; excellent paſturage for ſheep; and affords great plenty of ſea and water fowl, and all kinds of fiſh upon the coaſts. There is in effect no port, though they have two that are nominally ſo: one at the ſouth end, which is full of rocks, where only ſmall boats can lie; the other at the north-eaſt end, larger and ſafer in ſummer, ſo that it ſerves commodiouſly enough for their fiſhery. The duke of Medina Sidonia, when commander of the famous Spaniſh armada in 1588, was wrecked on the eaſt coaſt of this iſland. The ſhip broke to pieces, but the duke and 200 made their eſcape. They lived here ſo long, that both they and the inhabitants were almoſt famiſhed. At length the duke and the poor remains of his people were carried over to the main land of Shetland, and then to Dunkirk, by one Andrew Humphry, for which ſervice Andrew was rewarded with 3000 merks. This iſland produced to its former proprietor between 50l. and 60 ſterling. It was ſold at Edinburgh in 1766, for about 85cl. to James Stewart of Burgh, Eſq.

FAIR-curve, is a winding line, uſed in delineating ſhips, whoſe ſhape is varied, according to the part of the ſhip which it is intended to deſcribe.

FAIR-way, in ſea language, the path or channel of a narrow bay, river, or haven, in which ſhips uſually

advance

Fairfax || Fairy.

advance in their paſſage up and down; ſo that if any veſſels are anchored therein, they are ſaid to lie in the fair-way.

FAIRFAX, EDWARD, natural ſon of Sir Thomas Fairfax, was an Engliſh poet who lived in the reigns of Elizabeth and James I. He wrote ſeveral poetical pieces, and was an accompliſhed genius. Dryden introduces Fairfax with Spenſer, as the leading writers of the times; and even ſeems to give the preference to the former in the way of harmony, when he obſerves that Waller owned himſelf indebted for the harmony of his numbers to Fairfax's *Godfrey of Boulogne*. He died about the year 1632, at his own houſe called *Newhall*, in the pariſh of Fuyſton, between Denton and Knareſborough, and lies under a marble ſtone.

FAIRFAX, *Sir Thomas*, general of the parliamentary forces againſt Charles I. in 1644. See (*Hiſtory of*) BRITAIN, N° 127. *et ſeq.* He reſigned in 1650; after which he lived privately, till he was invited by General Monk to aſſiſt him againſt Lambert's army. He cheerfully embraced the occaſion; and, on the third of December 1659, appeared at the head of a body of gentlemen of Yorkſhire; when, upon the reputation of his name, a body of 12,000 men forſook Lambert and joined him. He was at the head of the committee appointed by the houſe of commons to attend King Charles II. at the Hague, to deſire him ſpeedily to return to England; and having readily aſſiſted in his reſtoration, returned again to his ſeat in the country; where he lived in a private manner till his death, which happened in 1671, in the 60th year of his age.—He wrote, ſays Mr Walpole, Memorials of Thomas Lord Fairfax, printed in 1699; and was not only an hiſtorian, but a poet. In Mr Thoreſby's muſeum were preſerved in manuſcript the following pieces: The Pſalms of David, the Canticles, the Songs of Moſes, and other parts of Scripture, verſified; a poem on Solitude; Notes of Sermons, by his lordſhip, by his lady daughter of Horace Lord Vere, and by their daughter Mary the wife of George ſecond duke of Buckingham: and a Treatiſe on the Shortneſs of Life. But of all Lord Fairfax's works, ſays Mr Walpole, the moſt remarkable were the verſes he wrote on the horſe on which Charles II. rode to his coronation, and which had been bred and preſented to the king by his lordſhip. How muſt that merry monarch, unapt to keep his coutenance on more ſerious occaſions, have ſmiled at this awkward homage from the old victorious hero of republicaniſm and the covenant! He gave a collection of manuſcripts to the Bodleian library.

FAIRFORD, a town in Glouceſterſhire, with a market on Thurſdays. It is remarkable for the church, which has curious painted glaſs windows. They are ſaid to have been taken in a ſhip by John Tame, Eſq. towards the end of the 15th century, who built the church for their ſake. They are preſerved entire, and the figures are extremely well drawn and coloured. They repreſent the moſt remarkable hiſtories in the Old and New Teſtament. They are frequently viſited by travellers, and many go on purpoſe to view them, as one of the greateſt curioſities in England. The painter was Albert Durer. W. Long. 1. 46. N. Lat. 51. 42.

FAIRY, in ancient traditions and romances, ſignifies a ſort of deity, or imaginary genius, converſant on the earth, and diſtinguiſhed by a variety of fantaſtical actions either good or bad. Fairy:

They were moſt uſually imagined to be women of an order ſuperior to human nature, yet ſubject to wants, paſſions, accidents, and even death; ſprightly and benevolent while young and handſome; moroſe, peeviſh, and malignant, if ugly, or in the decline of their beauty; fond of appearing in white, whence they are often called the *white ladies*.

Concerning theſe imaginary beings, no leſs a perſon than Jervaiſe of Tilleberry, marſhal of the kingdom of Arles, who lived in the beginning of the 13th century, writes thus in a work inſcribed to the emperor Otho IV. "It has been aſſerted by perſons of unexceptionable credit, that fairies uſed to chooſe themſelves gallants from among men, and rewarded their attachment with an affluence of wordly goods; but if they married, or boaſted of a fairy's favours, they as ſeverely ſmarted for ſuch indiſcretion." The like tales ſtill go current in Languedoc; and throughout the whole province, there is not a village without ſome ancient ſeat or cavern which had the honour of being a fairy's reſidence, or at leaſt ſome ſpring where a fairy uſed to bathe. This idea of fairies has a near affinity with that of the Greeks and Romans, concerning the nymphs of the woods, mountains, and ſprings; and an ancient ſcholiaſt on Theocritus ſays, "The nymphs are demons which appear on the mountains in the figure of women:" and what is more ſurpriſing, the Arabs and other orientals have their *ginn* and *peri*, of whom they entertain the like notions.

But fairies have been likewiſe deſcribed as of either ſex, and generally as of minute ſtature, though capable of aſſuming various forms and dimenſions. The moſt charming repreſentation imaginable of theſe children of romantic fancy, is in the *Midſummer Night's Dream* of Shakeſpear; in referring to which, we no doubt have been anticipated by the recollection of almoſt every reader.

Spenſer's Faery Queene is an epic poem, under the perſons and characters of fairies. This ſort of poetry raiſes a pleaſing kind of horror in the mind of the reader, and amuſes his imagination with the ſtrangeneſs and novelty of the perſons who are repreſented in it; but, as a vehicle of inſtruction, the judicious object to it, as not having probability enough to make any moral impreſſion.

The belief of fairies ſtill ſubſiſts in many parts of our own country. The

"Swart fairy of the mine"

(of German extraction), has ſcarce yet quitted our ſubterraneous works; (*vid.* next article.) *Puck*, or *Robin Good-Fellow*, ſtill haunts many of our villages. And in many parts of Scotland, new born children are watched till the chriſtening is over, leſt they ſhould be ſtolen or changed by ſome of theſe fantaſtical exiſtences.

FAIRY of the Mine; an imaginary being, an inhabitant of mines. The Germans believed in two ſpecies; one fierce and malevolent: the other a gentle race, appearing like little old men dreſſed like the miners, and not much above two feet high. Theſe wander about the drifts and chambers of the works; ſeem perpetually employed,

Fairy, Faith.

employed, yet do nothing; ſome ſeem to cut the ore, or fling what is cut into veſſels, or turn the windlaſs: but never do any harm to the miners, unleſs provoked; as the ſenſible Agricola, in this point credulous, relates in his book *de Animantibus Subterraneis*.

Fairy Circle or *Ring*, a phenomenon pretty frequent in the fields, &c. ſuppoſed by the vulgar to be traced by the fairies in their dances. There are two kinds of it; one of about ſeven yards in diameter, containing a round bare path, a foot broad, with green graſs in the middle of it. The other is of different bigneſs, encompaſſed with a circumference of graſs. Meſſ. Jeſſop and Walker, in the Philoſophical Tranſactions, aſcribe them to lightning; which is thought to be confirmed by their being moſt frequently produced after ſtorms of that kind, as well as by the colour and brittleneſs of the graſs roots when firſt obſerved. Lightning, like all other fires, moves round, and burns more in the extremity than in the middle: the ſecond circle ariſes from the firſt, the graſs burnt up growing very plentifully afterwards. Others maintain that theſe circles are made by ants, which are frequently found in great numbers therein.—Mr Cavallo, in his treatiſe on electricity, does not think that lightning is at all concerned in the formation of them: "They are not (ſays he) always of a circular figure; and, as I am informed, they ſeem to be rather beds of muſhrooms than the effects of lightning."

We have frequently obſerved beds of muſhrooms arranged in a circular form like what are called fairy rings; but it will be difficult to account for the muſhroom ſeed being diſpoſed in this manner. It is probable that the ſeed is diſperſed over the whole field, and remains dormant till it is acted on by ſome ſtimulus to excite its vegetating powers. Perhaps this ſtimulus is atmoſpheric electricity, which acting on particular ſpots only, produces on them an abundant crop of muſhrooms, while none appear in other places.

FAITH, in *Philoſophy* and *Theology*, that aſſent which we give to a propoſition advanced by another, the truth of which we do not immediately perceive from our own reaſon or experience; or it is a judgment or aſſent of the mind, the motive whereof is not any intrinſic evidence, but the authority or teſtimony of ſome other who reveals or relates it. Hence, as there are two kinds of authorities and teſtimonies, the one of God, and the other of man, faith becomes diſtinguiſhed into divine and human.

Divine Faith, is that founded on the authority of God; or it is that aſſent we give to what is revealed by God.

The objects of this faith, therefore, are matters of revelation. See Revelation and Religion.

Human Faith, is that whereby we believe what is told us by men. The object hereof is matter of human teſtimony and evidence. See Metaphysics.

Faith, in practical theology, makes the firſt of the theological virtues or graces.

Faith in God, in this ſenſe, denotes ſuch a conviction of his being, perfections, character, and government, as produces love, truſt, worſhip, obedience, and reſignation.

Faith in Chriſt, as it has been defined by ſome, is a mere aſſent to the goſpel as true; according to others, it ſignifies ſuch a perſuaſion that he is the Meſſiah, and ſuch a deſire and expectation of the bleſſings which he has promiſed in his goſpel to his ſincere diſciples, as engage the mind to fix its dependence upon him, and ſubject itſelf to him in all the ways of holy obedience. See Theology.

Faith || Fakirs.

Faith, likewiſe, in reſpect to futurity, is a moral principle, implying ſuch a conviction of the reality and importance of a future ſtate, as is ſufficient to regulate the temper and conduct.

Faith, or *Fidelity* (*Fides*), was deified by the ancient Romans, and had a temple in the Capitol conſecrated to her by Attilius Catalinus. Her prieſts wore white veils: unbloody ſacrifices were offered to her, and the greateſt oaths were taken in her name. Horace clothes her in white, places her in the retinue of Fortune, and makes her the ſiſter of Juſtice, *Od.* 24, 35. l. i. Public Faith is repreſented in a great number of medals; ſometimes with a baſket of fruit in one hand, and ſome ears of corn in the other; and ſometimes holding a turtle-dove. But the moſt uſual ſymbol is two hands joined together. The inſcriptions are generally, *Fides Auguſti*, *Fides Exercitus*, or *Fides Militum*, &c.

FAITHFUL, an appellation aſſumed by the Mahometans. See Mahometans.

FAITHORN, William, an ingenious Engliſh artiſt, a native of London, was the diſciple of Peak the painter, and worked with him three or four years. At the breaking out of the civil war, Peak eſpouſed the cauſe of his ſovereign: and Faithorn, who accompanied his maſter, was taken priſoner by the rebels at Baringhouſe, from whence he was ſent to London, and confined in Alderſgate. In this uncomfortable ſituation he exerciſed his graver; and a ſmall head of the firſt Villars duke of Buckingham, in the ſtyle of Melan, is reckoned among his performances at that time. The ſolicitations of his friends in his favour at laſt prevailed; and he was releaſed from priſon, with permiſſion to retire to the continent. In France he found protection and encouragement from the Abbé de Marolles; and it was at this time that he formed an acquaintance with Nanteuil, from whoſe inſtructions he derived very conſiderable advantages. About the year 1650 he returned to England, and ſoon after married the ſiſter of a Captain Cround. By her he had two ſons; Henry, who was a bookſeller, and William an engraver in mezzotinto. Faithorn opened a ſhop near Temple-Bar, where he ſold not only his own engravings, but thoſe of other Engliſh artiſts, and imported a conſiderable number of prints from Holland, France, and Italy. About the year 1680, he retired from his ſhop, and reſided in Printing-Houſe Yard; but he ſtill continued to work for the bookſellers, eſpecially Royſton, Martin, and Peak the younger, his former maſter's brother. He painted portraits from the life in crayons; which art he learned of Nanteuil during his abode in France. He alſo painted in miniature; and his performances in both theſe ſtyles were much eſteemed. His ſpirits were broken by the indiſcretion and diſſipation of his ſon William; and a lingering conſumption put an end to his life in 1691. He wrote a book *Upon Drawing, Graving, and Etching*, for which he was celebrated by his friend Thomas Flatman the poet.

FAKIRS, Indian monks or friars. They outdo the

Fakirs, Falaſha.

the ſeverity and mortification of the ancient Anchorets or Solitaries. Some of them make a vow of continuing all their lifetime in one poſture, and keep it effectually. Others never lie down; but continue in a ſtanding poſture all their lives, ſupported only by a ſtick, or rope under their arm pits. Some mangle their bodies with ſcourges and knives. They look upon themſelves to have conquered every paſſion, and triumphed over the world; and accordingly ſcruple not, as if in a ſtate of innocence, to appear entirely naked in public.

The common people of Eaſt India are thoroughly perſuaded of the virtue and innocence of the fakirs; notwithſtanding which, they are accuſed of committing the moſt enormous crimes in private.

They have alſo another kind of fakirs, who do not practiſe ſuch ſeverities: theſe flock together in companies, and go from village to village; propheſying, and telling fortunes. They are wicked villains, and it is dangerous for a man to meet them in a lone place: nevertheleſs the Indian idolaters have them in the utmoſt veneration. They make uſe of drums, trumpets, and other muſical inſtruments, to rouſe their ſouls, and work themſelves up to an artificial ecſtaſy, the better to publiſh their pretended prophecies.

Some of the votaries of theſe ſages moſt devoutly kiſs their privy parts; and they receive this monſtrous declaration of reſpect with a kind of ecſtatic pleaſure. The moſt ſober and diſcreet Indians conſult them in this prepoſterous attitude; and their female votaries converſe with them a conſiderable time with the moſt indecent freedom.

The fire they burn is made of cows dung, dried in the ſun. When they are diſpoſed to ſleep, they repoſe themſelves on cows dung, and ſometimes on ordure itſelf. They are ſo indulgent towards every living creature, that they ſuffer themſelves to be overrun with vermine, or ſtung by inſects, without the leaſt reluctancy or complaint.

It is more than probable, thoſe Indian friars have ſome ſecret art to lull their ſenſes aſleep, in order to render themſelves in a great meaſure inſenſible of the exceſſive torments they voluntarily undergo. Ovington aſſures us, that "as he was one day in an aſſembly of fakirs, he obſerved, that they drank opiates infuſed in water; the intoxicating virtue thereof was enough to turn their brain."

The garment of the chief fakirs conſiſts of three or four yards of orange-coloured linen, which they tie round them, and a tiger's ſkin, which hangs over their ſhoulders. Their hair is woven in treſſes, and forms a kind of turban. The ſuperior of the fakirs is diſtinguiſhed from the reſt by having a greater number of pieces in his garment, and by a chain of iron, two yards long, tied to his leg. When he deſigns to reſt in any place, a garment is ſpread upon the ground; on which he ſits and gives audience, whilſt his diſciples publiſh his virtues.

Some perſons of quality in India have become fakirs: among others, five great lords belonging to the court of Schah Gehan, Mogul of the Indies. It is ſaid, there are about two millions of fakirs in the Eaſt Indies.

FALASHA, a people of Abyſſinia, of Jewiſh origin, deſcribed by Mr Bruce, who was at great pains to acquaint himſelf with their hiſtory by cultivating the friendſhip of the moſt learned perſons among them he could meet with. Falaſha.

According to the accounts received from them, the Falaſha are the deſcendants of thoſe Jews who came from Paleſtine into Ethiopia, as attendants of Menilek the ſon of the queen of Sheba or Saba by Solomon. They agree in the relations given by the Abyſſinians of that princeſs, but deny that the poſterity of thoſe who came with Menilek ever embraced the Chriſtian religion, as the Abyſſinians ſay they did. They ſay, that at the decline of the Jewiſh commerce, when the ports of the Red ſea fell into the hands of other nations, and no intercourſe took place betwixt them and Jeruſalem, the Jewiſh inhabitants quitted the ſea coaſts and retired into the province of Dembea. While they remained in the cities on the Red ſea, they exerciſed the trade of brick and tile making, pottery, thatching houſes, &c. and after leaving the ſea coaſts, they choſe the country of Dembea on account of the plenty of materials it afforded for exerciſing the trades they profeſſed. Here they carried the art of pottery to a great degree of perfection, multiplied exceedingly, and became very numerous and powerful about the time that the Abyſſinians were converted to Chriſtianity. As this event was accounted by them an apoſtaſy from the true religion, they now ſeparated themſelves from the Abyſſinians, and declared one Phineas, of the line of Solomon, their king. Thus they ſay, they have ſtill a prince of the houſe of Judah for their ſovereign, though their aſſertion is treated with contempt, and a nickname beſtowed on the Falaſhan family by the other Abyſſinians. About the year 960, the queen of this people, after extirpating the Abyſſinian princes on the rock Damo, aſſumed the ſovereignty of the whole empire, which they retained for ſome time; but their power being by degrees reduced, they were obliged to take up their reſidence among the rugged mountains of Samen; one of which they choſe for their capital, and which has ever ſince been called the *Jew's Rock*. About the year 1600, they were almoſt entirely ruined by an overthrow from the Abyſſinians, in which both their king and queen were ſlain; ſince which time they have been in ſubjection to the emperors of that country, but are ſtill governed by their own princes. When Mr Bruce was in Abyſſinia they were ſuppoſed to amount to about 100,000 effective men. Gideon and Judith were the names of the king and queen at that time; and theſe, according to our author, ſeem to be preferred to others for the royal family.

The language of this people is very different from the Hebrew, Samaritan, or any other which the Jews ever ſpoke in their own country. On being interrogated concerning it by Mr Bruce, they ſaid, that it was probably one of thoſe ſpoken by the nations on the Red ſea, among whom they had ſettled at their firſt coming. They arrived in Abyſſinia ſpeaking Hebrew, and with the advantage of having books in that language; but had now forgot it, which indeed is not to be wondered at, as they had loſt their Hebrew books, and were entirely ignorant of the art of writing. At the time of their leaving Jeruſalem, they were in poſſeſſion both of the Hebrew and Samaritan copies of the law; but when their fleet was deſtroyed in the

Falcade || Falcon.

time of Rehoboam, and no farther communication with Jeruſalem took place, they were obliged to uſe tranſlations of the Scriptures, or thoſe copies which were in poſſeſſion of the ſhepherds, who, they ſay, were all Jews before the time of Solomon. On being aſked, however, where the ſhepherds got their copy, and being told, that, notwithſtanding the invaſion of Egypt by Nebuchadnezzar, there was ſtill a communication with Jeruſalem by means of the Iſhmaelite Arabs through Arabia, they frankly acknowledged that they could nor tell: neither had they any memorials of the hiſtory either of their own or any other country; all that they believed in this caſe being derived from mere tradition, their hiſtories, if any exiſted, having been deſtroyed by the famous Mooriſh captain Gragné. They ſay that the firſt book of Scripture they received was that of Enoch; and they place that of Job immediately after it, ſuppoſing that patriarch to have lived ſoon after the flood. They have no copy of the Old Teſtament in the Falaſha language, what they make uſe of being in that of Geez. This is ſold to them by the Abyſſinian Chriſtians, who are the only ſcribes in that country. No difference takes plaoe about corruptions of the text; nor do the Falaſha know any thing of the Jewiſh Talmud, Targum, or Cabala. See ABYSSINIA.

FALCADE, in the manege, the motion of a horſe when he throws himſelf upon his haunches two or three times, as in very quick curvets; which is done in forming a ſtop and half ſtop. See STOP.

FALCATED, ſomething in the form of a ſickle: thus the moon is ſaid to be *falcated* when ſhe appears horned.

FALCO, the eagle and hawk, a genus of birds belonging to the order of accipitres. See ORNITHOLOGY *Index*.

FALCON, or FAUCON, a bird of prey of the hawk kind, ſuperior to all others for courage, docility, gen-
* See *Falco.* tleneſs, and nobleneſs of nature *. Several authors take the name *falcon* to have been occaſioned by its crooked talons or pounces, which reſemble a falx or ſickle. Giraldus derives it *à falcando*, becauſe it flies in a curve.

The falcon, or falcon gentle, is both for the fiſt and for the lure. In the choice, take one that has wide noſtrils, high and large eyelids, a large black eye; a round head, ſomewhat full on the top; barb feathers on the clap of the beaks, which ſhould be ſhort, thick, and of an azure colour; the breaſt large, round, and fleſhy; and the thighs, legs, and feet, large and ſtrong, with the fear of the foot ſoft and bluiſh: the pounces ſhould be black, with wings long and croſſing the train, which ſhould be ſhort and very pliable.

The name *falcon* is reſtrained to the female: for the male is much ſmaller, weaker, and leſs courageous, than the female; and therefore is denominated *taſſel*, or *tircelet*. The falcon is excellent at the river, brook, and even field; and flies chiefly at the larger game, as wild gooſe, kite, crow, heron, crane, pye, ſhoveler, &c. For further particulars, ſee FALCONRY and HAWKING.

The cuſtom of carrying a falcon extended to many countries, and was eſteemed a diſtinction of a man of rank. The Welſh had a ſaying, That you may know a gentleman by his hawk, horſe, and greyhound. In fact, a perſon of rank ſeldom went without one on his hand. Harold, afterwards king of England, is painted going on a moſt important embaſſy, with a hawk on his hand and a dog under his arm. Henry VI. is repreſented at his nuptials, attended by a nobleman and his falcon. Even the ladies were not without them in earlier times; for in an ancient ſculpture in the church of Milton Abbas, in Dorſetſhire, appears the conſort of King Athelſtan with a falcon on her royal fiſt tearing a bird.

Falconer, Falconry.

FALCONER, a perſon who brings up, tames, and makes, that is, tutors and manages, birds of prey; as falcons, hawks, &c. See FALCONRY.

The grand ſignior, it is ſaid, uſually keeps 6000 falconers in his ſervice.—The French king had formerly a grand falconer, which was an office diſmembered from that of great hunter, *grand veneur*. Hiſtorians take notice of this poſt as early as the year 1250.

A falconer ſhould be well acquainted with the quality and mettle of his hawks, that he may know which of them to fly early and which late. Every night after flying he ſhould give them caſting; one while plumage, ſometimes pellets of cotton, and at another time phyſic, as he finds neceſſary. He ought alſo every evening to make the place clean under the perch, that by her caſting he may know whether ſhe wants ſcouring upwards or downwards. Nor muſt he forget to water his hawk every evening, except on ſuch days as ſhe has bathed; after which, at night, ſhe ſhould be put into a warm room, having a candle burning by her, where ſhe is to ſit unhooded, if ſhe be not ramage, that ſhe may pick and prune herſelf.—A falconer ſhould always carry proper medicines into the field, as hawks frequently meet with accidents there. Neither muſt he forget to take with him any of his hawking implements; and it is neceſſary he ſhould be ſkilful in making lures, hoods of all ſorts, jeſſes, bewets, and other furniture. Neither ought he to be without his coping irons, to cope his hawk's beak when overgrown, and to cut her pounces and talons as there ſhall be occaſion: nor ſhould his cauterizing irons be wanting.

FALCONER, *William*, an ingenious Scots ſailor, who, about the year 1762, came up to London with a pretty pathetic poem, called the *Shipwreck*, founded on a diſaſter of his own experience. The publication of this piece recommended him to the late duke of York; and he would in all probability have been ſuitably preferred, if a ſecond ſhipwreck, as may be ſuppoſed, had not proved fatal to him, and to many gentlemen of rank and fortune with whom he ſailed. In 1770, he went out a volunteer in the Aurora frigate, ſent to carry Meſſrs Vanſittart, Scraſton, and Ford, the ſuperviſors appointed to regulate our Eaſt India ſettlements; which veſſel, after it had touched at the Cape of Good Hope, was never more heard of. Before his departure, he publiſhed a very uſeful Marine Dictionary, in one volume 4to.

FALCONRY, a kind of ſport or amuſement, reſpecting the antiquity of which different opinions have been entertained by the learned. It is denied by Blondus, Laurentius Valla, and others, that the ancient Greeks knew any thing about falconry; but the learned Profeſſor Beckmann, on the moſt unequivocal authority, maintains that they did. He admits that they might be ignorant of the art of hawking, or of chaſing

Falconry. chaſing game with birds trained for that purpoſe; but he contends that they employed ſome ſpecies of the moſt rapacious of the winged tribe in hunting and fowling. In the days of Cteſias, the Indians hunted hares and foxes by means of rapacious birds; and Ariſtotle ſays expreſsly, "In Thrace, the men go out to catch birds with hawks. They beat the reeds and buſhes which grow in marſhy places, in order to raiſe the ſmall birds, which the hawks purſue and drive to the ground, where the fowlers kill them with poles."

Reſpecting Thrace, which is ſituated above Amphipolis, a wonderful circumſtance is related, which to many may appear almoſt incredible. We are informed that boys went into the fields, and purſued birds by the aſſiſtance of hawks. When they found a convenient place for their purpoſe, they called their hawks by their particular names, which came immediately on hearing their voices, and purſued the birds into the buſhes, where the boys killed them with ſticks, and thus made them their prey. When the hawks themſelves laid hold of any birds, they threw them to the fowlers, and received, for their fidelity, a ſhare of the game. If we add the ſpaniel, now employed to find out the game, the hood placed upon the head of the hawk, and the thong for holding it, we may clearly perceive in theſe ancient accounts the practice of modern times. Falconers ſtill give a portion of the game to the hawk, as was the uſual practice of the boys at Thrace.

According to the teſtimony of Phile, Pliny, Ælian, and others, the birds were ſometimes driven into nets by the hawks employed in theſe ſports. From India and Thrace, therefore, it ſeems manifeſt, that the Greeks obtained their firſt information as to the method of fowling with birds of prey; but they themſelves do not appear to have adopted the practice at a very early period. In Italy, however, it muſt have been extremely well underſtood, ſince it is mentioned by Martial and Apuleius as a thing everywhere known. After being once known, it was never totally forgotten; but it ſhared the fate of other inventions in this reſpect, that it was originally admired, and afterwards much neglected, by which means it received no material improvements for a conſiderable time; yet it was at length brought to the utmoſt perfection. We find mention made of this ſport in the Roman laws, and in many authors of the fourth and ſubſequent century. In the time of Conſtantine the Great, Julius Firmicus Maternus aſſures us, according to the ſuperſtitious notions of that period, that ſuch as are born under certain ſigns, will become great ſportſmen, and keep hounds and falcons. Sidonius, who flouriſhed about the end of the fifth century, praiſes Herdicius, the brother of his wife, becauſe he was the firſt in his territories who practiſed hunting and fowling with dogs and hawks.

Falconry appears to have been carried to the greateſt perfection, and to have been much eſteemed at the chief courts of Europe, ſo early as the 12th century, for which reaſon ſome have aſcribed the invention to the emperor Frederic I. whereas he appears to have been only the firſt who introduced the practice into Italy, according to the teſtimony of Rodericus and Collenuccio; and Frederic II. wrote a book entitled, *De arte venandi cum avibus*, to which the practice has been much indebted. Falconry has had a number of admirers among the fair ſex, perhaps in a ſuperior degree to any other ſport or amuſement whatever of a ſimilar nature; but their attachment was deſtroyed by the invention of gunpowder, which was accompanied both with alarm and danger. We conclude our remarks on the hiſtory of falconry with an obſervation of Demetrius, who flouriſhed in the 13th century, and who expreſsly wrote at large upon this ſubject. He deſires ſportſmen to ſay their prayers (Τον θεον επικαλεισαντες) before they go out to the field, which appears wholly incompatible with the practice of modern times, and ſeems as impious as to crave aſſiſtance of God when preparing for a piratical expedition. Falconry.

Falconry, the art of training all manner of hawks, but more eſpecially the larger ones called *falcons*, to the exerciſe of hawking. See Hawking.

When a falcon is taken, ſhe muſt be feeled in ſuch a manner, that, as the feeling ſlackens, ſhe may ſee what proviſion lies before her; but care ought to be taken, not to feel her too hard. A falcon or hawk newly taken ſhould have all new furniture, as new jeſſes of good leather, mailled leaſhes with buttons at the end, and new bewets. There ſhould alſo be provided a ſmall round ſtick, to ſtroke the hawk; becauſe, the oftener this is done, the ſooner and better will ſhe be manned. She muſt alſo have two good bells, that ſhe may be found when ſhe ſcattereth. Her hood ſhould be well faſhioned, raiſed, and emboſſed againſt her eyes, deep, and yet ſtrait enough beneath, that it may faſten about her head without hurting her; and her beak and talons muſt be a little coped, but not ſo near as to make them bleed.

If it be a ſoar-falcon, which had already paſſed the ſeas, ſhe will indeed be harder to reclaim, but will prove the beſt of falcons. Her food muſt be good and warm, and given her twice or thrice a-day, till ſhe be full gorged: the beſt for this purpoſe is pigeons, larks, or other live birds; becauſe ſhe muſt be broken off by degrees from her accuſtomed feeding. When ſhe is fed, you muſt hoop and lure, as you do when you call a hawk, that ſhe may know when you intend to give her meat. On this occaſion ſhe muſt be unhooded gently; and after giving her two or three bits, her hood muſt be put on again, when ſhe is to get two or three bits more. Care muſt be taken that ſhe be cloſe feeled; and after three or four days, her diet may be leſſened: the falconer ſetting her every night to perch by him, that he may awaken her often in the night. In this manner he muſt proceed, till he find her to grow tame and gentle; and when ſhe begins to feed eagerly, he may give her a ſheep's heart. He may now begin to unhood her in the day time; but it muſt be far from company, firſt giving her a bit or two, then hooding her gently, and giving her as much more. When ſhe is ſharp ſet, he may now unhood her, and give her ſome meat juſt againſt his face and eyes, which will make her leſs afraid of the countenance of others. She muſt be borne continually on the fiſt, till ſhe is properly manned, cauſing her to feed in company, giving her in the morning, about ſunriſe, the wing of a pullet; and in the evening, the foot of a hare or coney, cut off above the joint, flayed and laid in water, which being ſqueezed, is to be given her with the pinion of a hen's wing. For two or three days give her waſhed meat, and then plumage in more or leſs quantity as ſhe is thought to be more or leſs foul within. After this, being hooded again, ſhe

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Falconry, Falerii.

is to get nothing till ſhe has gleamed and caſt, when a little hot meat may be given her in company; and, towards evening, ſhe may be allowed to plume a hen's wing in company alſo. Cleanſe the feathers of her caſting, if foul and ſlimy; if ſhe be clean within, give her gentle caſtings; and when ſhe is reclaimed, manned, and made eager and ſharp ſet, he may venture to feed her on the lure.

However, three things are to be conſidered before the lure be ſhowed her; 1. That ſhe be bold and familiar in company, and not afraid of dogs and horſes. 2. Sharp ſet and hungry, having regard to the hour of morning and evening, when you would lure her. 3. Clean within, and the lure well garniſhed with meat on both ſides; and when you intend to give her the length of a leaſh, you muſt abſcond yourſelf.

She muſt alſo be unhooded, and have a bit or two given her on the lure as ſhe ſits on your fiſt; afterwards take the lure from her, and hide it that ſhe may not ſee it; and when ſhe is unſeeled, caſt the lure ſo near her, that ſhe may catch it within the length of her leaſh, and as ſoon as ſhe has ſeized it, uſe your voice as falconers do, feeding her upon the lure, on the ground, with the heart and warm thigh of a pullet.

Having ſo lured your falcon, give her but little meat in the evening; and let this luring be ſo timely, that you may give her plumage, and a juck of a joint next morning on your fiſt. When ſhe has caſt and gleamed, give her a little reaching of warm meat. About noon, tie a creance to her leaſh; and going into the field, there give her a bit or two upon her lure: then unwind the creance, and draw it after you a good way; and let him who has the bird hold his right hand on the taſſel of her hood, ready to unhood her as ſoon as you begin to lure; to which if ſhe come well, ſtoop roundly upon it, and haſtily ſeize it, let her caſt two or three bits thereon. Then, unſeizing and taking her off the lure, hood her and give her to the man again; and, going farther off, lure and feed her as before.

In this manner is the falconer to proceed, luring her every day farther and farther off, till ſhe is accuſtomed to come freely and eagerly to the lure; after which ſhe may be lured in company, taking care that nothing affright her. When ſhe is uſed to the lure on foot, ſhe is to be lured on horſeback; which may be effected the ſooner, by cauſing horſemen to be about her when ſhe is lured on foot.

When ſhe has grown familiar to this way, let ſomebody on foot hold the hawk, and he on horſeback muſt call and caſt the lure about his head, the holder taking off the hood by the taſſel; and if ſhe ſeize eagerly on the lure without fear of man or horſe, then take off the creance, and lure her at a greater diſtance. And if you would have her love dogs as well as the lure, call dogs when you give her her living or plumage. See HAWKING.

FALERII, in *Ancient Geography*, a town of Etruria, on the weſt or right ſide of the Tiber; Faliſci, the people of the town and territory. The territory was famous for its rich paſtures; hence the *gramen Faliſcum* in authors. Eutropius and Frontinus call the town *Faliſci*; which, according to the laſt, was ſurnamed *Colonia Junonia*. The Faliſci are called *Æqui* by Virgil; becauſe they afforded ſupplemental laws to the 12 tables, (Servius). Here they made an excellent ſauſage, called *Venter Faliſcus* (Martial).

Falernus || Falkirk.

When the Faliſci were beſieged by Camillus, a ſchoolmaſter went out of the gates of the city with his pupils, and propoſed to betray them into the hands of the Roman enemy, that by ſuch a poſſeſſion he might eaſily oblige the place to ſurrender. Camillus heard the propoſal with indignation, and ordered the man to be ſtripped naked, and whipped back to the town by thoſe whom his perfidy willed to betray. This inſtance of generoſity operated upon the people ſo powerfully that they ſurrendered to the Romans.

FALERNUS, *Mons Maſſicus* ſo called, (Martial); Falernus ager, a diſtrict at the foot of Mount Maſſicus in Campania; famous for its generous wines, (Horace, Pliny). Now called *Monte Maſſico*.

FALISCI. See FALERII.

FALKIA, a genus of plants belonging to the hexandria claſs. See BOTANY *Index*.

FALKIRK, a town of Stirlingſhire in Scotland, ſituated in W. Long. 3. 48. N. Lat. 56. 20. It is a large ill built place, and is ſupported by great fairs for black cattle from the Highlands, it being computed that 24,000 head are annually ſold there. A great deal of money is alſo got here by the carriage of goods landed at Carron wharf to Glaſgow. This town is remarkable for a battle fought in its neighbourhood between Edward I. of England, and the Scots commanded by the ſteward of Scotland, Cummin of Badenoch, and Sir William Wallace. The latter had been inveſted with the ſupreme command; but perceiving that this gave umbrage to the nobility, he reſigned his power into the hands of the noblemen above mentioned, reſerving to himſelf only the command of a ſmall body who refuſed to follow another leader. The Scots generals placed their pikemen along the front, and lined the intervals between the three bodies of which their army was compoſed, with archers: and dreading the great ſuperiority of the Engliſh cavalry, endeavoured to ſecure their front by palliſadoes tied together with ropes. The battle was fought on the 22d of July 1298. The king of England divided his army likewiſe into three bodies; and by the ſuperiority of his archers, defeated the Scots with great ſlaughter. Wallace alone preſerved entire the troops he commanded; and retiring behind the Carron, marched leiſurely along the banks of that river, which protected him from the enemy. In this battle fell John de Graham, a gentleman much celebrated for his valour, and ſtyled the *right hand* of the gallant Wallace. His epitaph is ſtill to be ſeen on a plain ſtone in the churchyard of Falkirk. On the 18th of January 1746, a battle was fought here between the king's forces commanded by General Hawley, and the Highlanders headed by Charles Stuart. The former was ſeized with a panic, and fled: but Colonel Huſk with two regiments, who kept their ground, prevented the Highlanders from purſuing their victory. Extenſive ruins are perceived in the neighbourhood of this town, ſuppoſed by ſome antiquarians to have been the capital of the Pictiſh government; but others believe them to be the remains of ſome Roman ſtations.

FALKLAND, a ſmall town of Fifeſhire in Scotland, made a royal burgh by James II. in 1458. Here ſtood one of the ſeats of the Macduffs earls of Fife. On the

Falkland, Fall.

the attainder of Munro Stewart, the 17th earl, it became forfeited to the crown in 1424. James V. who grew very fond of the place, enlarged and improved it. The remains evince its former magnificence and elegance, and the fine taſte of the princely architect. The gateway is placed between two fine round towers; on the right hand joins the chapel, whoſe roof is of wood, handſomely gilt and painted, but in a moſt ruinous condition. Beneath are ſeveral apartments. The front next to the court was beautifully adorned with ſtatues, heads in baſs relief, and elegant columns not reducible to any order, but of fine proportion, with capitals approaching the Ionic ſcroll. Beneath ſome of theſe pillars was inſcribed I. R. M. G. 1537. or *Jacobus Rex, Maria de Guiſe*.—This place was alſo a favourite reſidence of James VI. on account of the fine park and plenty of deer. The eaſt ſide was accidentally burnt in the time of Charles II. and the park ruined during Cromwell's uſurpation, when the fine oaks were cut down in order to build the fort at Perth.—This place gives title of viſcount to the Engliſh family of Carey; Sir Henry Carey being ſo created by James VI. 1620. His ſon was the celebrated Lucius, who ſacrificed his life in a fit of loyal deſpair at the battle of Newbury, and from whom the preſent family is lineally deſcended.

FAIKLAND, *Lord*. See CAREY.

FALL, the deſcent of a heavy body towards the centre of the earth. It is alſo the name of a meaſure of length uſed in Scotland, containing ſix ells.

FALL of Man, in ſacred hiſtory, that terrible event by which ſin and death were introduced into the world. See ADAM, and ANTEDILUVIANS, and *Original SIN*. The account which Moſes gives of this tranſaction is extremely brief and conciſe. The ſerpent, he informs us, being more ſubtle than any beaſt of the field, aſked the woman, whether it was true that God had not granted her and her huſband leave to eat of every tree in the garden? She anſwered, That God had allowed them to eat of all, except only the fruit of the tree in the midſt of the garden; which he commanded they ſhould not taſte, nor ſo much as touch, leſt they ſhould die. The ſerpent replied, That they ſhould not die; for God knew the virtue of the tree; and that, ſo ſoon as they ate of it, their eyes would be opened, and they would become like gods, knowing good and evil. Eve, ſeeing the fruit tempting to the view, took of the fruit and ate; and gave alſo to her huſband of it, and he did eat. Immediately the eyes of both were opened; when perceiving they were naked, they ſewed fig leaves together and made themſelves aprons. Adam and Eve, hearing the voice of God walking in the garden in the cool of the day, hid themſelves among the trees; but, on God's calling for Adam, he excuſed himſelf for not appearing, becauſe he was naked. God demanded of him, who it was that told him he was naked; and whether he had diſobeyed his command, in eating the forbidden fruit? Adam confeſſed that the woman had offered him the fruit, and he had taſted it. She, being examined likewiſe, acknowledged what ſhe had done; but ſaid, the ſerpent had ſeduced and deceived her. God then proceeded to judgment; he firſt curſed the ſerpent above all beaſts, and condemned him to go on his belly, and eat the duſt; adding, that he would put enmity between him and the woman, and their offſpring; that the ſeed of the woman ſhould bruiſe the ſerpent's head, who ſhould bruiſe the other's heel. The woman was ſubjected to the pains of childbirth, as well as to the dominion of her huſband; and as to the man, God curſed the ground for his ſake, declaring, that it ſhould bring forth thorns and thiſtles, and he ſhould earn his bread by the ſweat of his brow, till he returned to the duſt, from whence he was taken. At laſt, having clothed them both with ſkins, he turned them out of the garden, leſt they ſhould take of the tree of life, and eat, and live for ever: then, to prevent any attempt to return to their former habitation, he placed cherubims at the eaſt of the garden, and a flaming ſword which turned every way, to guard the paſſage to the tree of life. Fall.

This conciſe account being, at firſt view, encumbered with ſome difficulties, ſeveral learned and pious men have been inclined to believe the whole ought to be taken in an allegorical ſenſe, and not according to the ſtrictneſs of the letter: they allege, that the ancients, and particularly the eaſtern nations, had two different ways of delivering their divinity and philoſophy, one popular, and the other myſterious; that the Scripture uſes both occaſionally; ſometimes accommodating itſelf to the capacities of the people, and at other times to the real but more veiled truth; and that, to obviate the many difficulties which occur in the literal hiſtory of this ſad cataſtrophe, the ſafeſt way is to underſtand it as a parabolical ſtory, under which the real circumſtances are diſguiſed and concealed, as a myſtery not fit to be more explicitly declared.

Though it cannot be denied that ſome of the ancient philoſophers affected ſuch an allegorical way of writing, to conceal their notions from the vulgar, and keep their learning within the bounds of their own ſchool; yet it is apparent Moſes had no ſuch deſign; and as he pretends only to relate matters of fact, juſt as they happened, without art or diſguiſe, it cannot be ſuppoſed but that this hiſtory of the fall is to be taken in a literal ſenſe, as well as the reſt of his writings. It is generally agreed, that the ſerpent which tempted Eve was the devil, who envying the privileges of man in innocence, tempted him, and was the cauſe of his forfeiting all thoſe advantages which he had received from God at his creation; and that to this end he aſſumed the form of a ſerpent. Theſe interpretations are ſupported by many paſſages of Scripture, where the devil is called the *ſerpent*, and the *old ſerpent*, (See John viii. 44. 2 Cor. xi. 3. and Rev. xii. 9.) Some believe that the ſerpent had then the uſe of ſpeech, and converſed familiarly with the woman, without her conceiving any diſtruſt of him; and that God, to puniſh the malice with which he had abuſed Eve, deprived him of the uſe of ſpeech. Others maintain, that a real ſerpent having eaten of the forbidden fruit, Eve from thence concluded, that ſhe too might eat of it without danger; that in effect ſhe did eat of it, and incurred the diſpleaſure of God by her diſobedience. This, ſay theſe laſt authors, is the plain matter of fact which Moſes would relate under the allegorical repreſentation of the ſerpent converſing with Eve.

The opinion of ſuch as believe this was not a real ſerpent, but only the devil under that name, is no leſs liable

Fallacy || Fallopian.

liable to exception than any of the reſt. For though the devil is frequently ſtyled in Scripture the *ſerpent*, and the *old ſerpent*, yet why he ſhould be called the *moſt ſubtle beaſt of the field*, we cannot conceive; neither will the puniſhment inflicted on the ſerpent ſuffer us to doubt, but that a ſerpent's body at leaſt was employed in the tranſaction.

The nature of the forbidden fruit is another circumſtance in this relation that has occaſioned no leſs variety of conjectures. The Rabbins believe it was the vine; others that it was wheat; and others, from the circumſtance of Adam and Eve's covering themſelves with fig leaves immediately after their tranſgreſſion, tell us, that this fruit muſt have been the fig; ſome think it was the cherry; and the generality of the Latins will have it to be the apple.

Thoſe who admire allegorical interpretations, will have the forbidden fruit to have been no other than the ſenſual act of generation, for which the puniſhment inflicted on the woman was the pain of childbearing. But this opinion has not the leaſt foundation in the words of Moſes, eſpecially if we conſider that Adam knew not his wife till after their expulſion out of Paradiſe.

Many have been the ſuppoſitions and conjectures upon this ſubject in general; and ſome have ſo far indulged their fancy in the circumſtances of the fall, that they have perverted the whole narration of Moſes into a fable full of the moſt ſhameful extravagancies.

FALLACY, a deception, fraud, or falſe appearance.

The Epicureans deny that there is any ſuch thing as a fallacy of the ſenſes: for, according to them, all our ſenſations and perceptions, both of ſenſe and phantaſy, are true; whence they make ſenſe the primary criterion of truth.

The Carteſians, on the other hand, maintain, that we ſhould ſuſpect as falſe, or at moſt as dubious, every thing that preſents itſelf to us by means only of the external ſenſes, becauſe they frequently deceive us. They add, that our ſenſes, as being fallacious, were never given us by nature for the diſcovery of truth, or the contemplation of the principles of things; but only for pointing out to us what things are convenient or hurtful to our bodies.

The Peripatetics keep a middle courſe. They ſay, that if a ſenſible object be taken in its common or general view, the ſenſe cannot be deceived about it; but that if the object be taken under its ſpecific view, the ſenſe may be miſtaken about it, from the want of the diſpoſitions neceſſary to a juſt ſenſation, as a diſorder in the organ, or any thing uncommon in the medium: thus, in ſome diſorders of the eye, all objects appear yellow; a ſtick in water appears broken or crooked, &c.

FALLING SICKNESS, or EPILEPSY. See MEDICINE *Index*.

FALLING-STARS. See STAR.

FALLOPIAN TUBES, in *Anatomy*, two ducts ariſing from the womb, one on each ſide of the fundus, and thence extended to the ovaries, having a conſiderable ſhare in conception. They are called *tubæ*, from their form, which bears ſome reſemblance to a trumpet; and their denomination *Fallopianæ*, they take from Gabriel Fallopius, mentioned in the next article. See ANATOMY *Index*.

Fallopius || Falſe.

FALLOPIUS, GABRIEL, a moſt celebrated phyſician and anatomiſt, was born at Modena in Italy, in the year 1523, and deſcended of a noble family. He made ſeveral diſcoveries in anatomy, one of which was that of the tubes, called from him the *Fallopian tubes*. He travelled through the greateſt part of Europe, and obtained the character of being one of the ableſt phyſicians of his age. He was made profeſſor of anatomy at Piſa in the year 1548, and at Padua in the year 1551: here he died in 1562, aged 39. His writings, which are numerous, were firſt printed ſeparately, and afterwards collected under the title of "Opera genuina omnia, tam practica quam theoretica, in tres tomos diſtributa." They were printed at Venice in 1585 and in 1606, at Francfort in 1600, *cum operum appendice*; and in 1606, in folio.

FALLOW, a pale red-colour, like that of brick half burnt; ſuch is that of a fallow deer.

Fallow Field, or *Fallow ground*; land laid up, or that has been untilled for a conſiderable time.

FALLOWING *of* LAND, a particular method of improving land. See AGRICULTURE *Index*.

FALMOUTH, a port town of Cornwall in England, ſituated in W. Long. 5. 30. N. Lat. 50. 15. on a fine bay on the Engliſh channel. It is the richeſt and moſt trading town of the county, and larger than any three of its boroughs that ſend members to parliament. It is ſo commodious a harbour, that ſhips of the greateſt burden come up to its quay. It is guarded by the caſtle of St Mawes and Pendennis, on a high rock at the entrance: and there is ſuch ſhelter in the many creeks belonging to it, that the whole royal navy may ride ſafe here in any wind, it being next to Plymouth and Milford-Haven, the beſt road for ſhipping in Great Britain. It is well-built; and its trade is conſiderably increaſed ſince the eſtabliſhment of the packet-boats here for Spain, Portugal, and the Weſt Indies, which not only bring vaſt quantities of gold in ſpecie and in bars, on account of the merchants in London; but the Falmouth merchants trade with the Portugueſe in ſhips of their own, and they have a great ſhare alſo in the gainful pilchard trade. The cuſtom-houſe for moſt of the Corniſh towns, as well as the head collector, is ſettled here, where the duties, including thoſe of the other ports, are very conſiderable. It is a corporation, governed by a mayor and alderman. Here is a market on Thurſday, and fairs July 27. and October 30.

FALSE, in general, ſomething contrary to truth, or not what it ought to be: thus we ſay a falſe action, falſe weights, falſe claim, &c.

False Action, if brought againſt one whereby he is caſt into priſon, and dies pending the ſuit, the law gives no remedy in this caſe, becauſe the truth or falſehood of the matter cannot appear before it is tried: and if the plaintiff is barred, or non-ſuited at common law, regularly all the puniſhment is amercement.

False Impriſonment, is a treſpaſs committed againſt a perſon, by arreſting and impriſoning him without juſt cauſe, contrary to law; or where a man is unlawfully detained without legal proceſs: and it is alſo

False || Fama.

so used for a writ which is brought for this trespass. If a person be any way unlawfully detained, it is false imprisonment; and considerable damages are recoverable in those actions.

False News, spreading of, in order to make discord between the king and nobility, or concerning any great man of the realm, is punishable by common law with fine and imprisonment; which is confirmed by statutes Westm. 1. 3 Edw. I. cap. 34. 2 Ric. II. stat. 1. cap. 5. and 12 Ric. II. cap. 11.

False Oath. See PERJURY.

False Prophecy. See PROPHECY.

False Quarter, in *Farriery*. See QUARTERS, FARRIERY *Index*.

False Bay, a bay lying to the eastward of the Cape of Good Hope; frequented by vessels during the prevalence of the north-westerly winds, which begin to exert their influence in May, and render it dangerous to remain in Table bay. It is terminated to the eastward by False Cape, and to the westward by the Cape of Good Hope. It is 18 miles wide at its entrance, and the two capes bear due east and west from each other.

FALSI CRIMEN, in the civil law, is fraudulent subornation or concealment, with design to darken or hide the truth, and make things appear otherwise than they are. The *crimen falsi* is committed, 1. By words, as when a witness swears falsely. 2. By writing, as when a man antedates a contract, or the like. 3. By deed, as when he sells by false weights and measures.

FALSIFY, in *Law*, is used for proving any thing to be false. Hence we find,

FALSIFYING a record, for showing it to be erroneous. Thus lawyers teach, that a person purchasing land of another, who is afterwards outlawed of felony, &c. may falsify the record, not only as to the time wherein the felony is supposed to have been committed, but also as to the point of the offence. But where a man is found guilty by verdict, a purchaser cannot falsify as to the offence; though he may for the time, where the party is found guilty generally in the indictment, because the time is not material upon evidence.

FALSTAFF. See FASTOLFF.

FALX, in *Anatomy*, a part of the dura mater, descending between the two hemispheres of the brain, and separating the fore part from the hinder. It is called *falx*, i. e. "sickle," because of its curvature, occasioned by the convexity of the brain. It divides the brain as low as the corpus callosum.

FAMA CLAMOSA, in the judicial procedure of the church of Scotland, a ground of action before a presbytery against one of its members, independent of any regular complaint by a particular accuser. See PRESBYTERY.

Any person who is of a good character, may give to the presbytery a complaint against one of their members; but the presbytery is not to proceed to the citation of the person accused, until the accuser under his hand gives in the complaint, with some account of its probability, and undertakes to make out the libel, under the pain of being considered as a slanderer. When such an accusation is brought before them, they are obliged candidly to examine the affair. But, besides this, the presbytery considers itself obliged to proceed against any of its members, if a fama clamosa of the scandal is so great that they cannot be vindicated unless they begin the process. This they can do without any particular accuser, after they have inquired into the rise, occasion, and authors, of this report. It is a maxim in the kirk of Scotland, that religion must suffer if the scandalous or immoral actions of a minister are not corrected. And wherever a minister is reputed guilty of any immorality (although before the most popular preacher in the kingdom), none almost will attend upon his ministry. Therefore the presbytery, for the sake of religion, is obliged to proceed against a minister in case of a fama clamosa. This, however, is generally done with great tenderness. After they have considered the report raised against him, then they order him to be cited, draw out a full copy of what is reported, with a list of the witnesses names to be led for proving this allegation. He is now to be formally summoned to appear before them; and he has warning given him, at least 10 days before the time of his compearance, to give in his answers to what is termed the *libel*; and the names of the witnesses ought also to be sent him. If at the time appointed the minister appear, the libel is to be read to him, and his answers are also to be read. If the libel be found relevant, then the presbytery is to endeavour to bring him to a confession. If the matter confessed be of a scandalous nature, such as uncleanness, the presbytery generally depose him from his office, and appoint him in due time to appear before the congregation where the scandal was given, and to make public confession of his crime and repentance. If a minister absent himself by leaving the place, and be contumacious, without making any relevant excuse, a new citation is given him, and intimation is made at his own church when the congregation is met, that he is to be holden as confessed, since he refused to appear before them; and accordingly he is deposed from his office.

Fama || Fame.

FAME, a heathen goddess, celebrated chiefly by the poets. She is feigned to have been the last of the race of Titans produced by the earth, to have her palace in the air, and to have a vast number of eyes, ears, and tongues. She is mentioned by Hesiod, and particularly described by Ovid and Virgil.

FAMES CANINA, the same with BULIMY.

FAMIA, or APAMIA, the modern name of one of the ancient Apameas. See APAMEA.

FAMILIARS of the INQUISITION, persons who assist in apprehending such as are accused, and carrying them to prison. They are assistants to the inquisitor, and called *familiars*, because they belong to his family. In some provinces of Italy they are called *cross-bearers*, and in others the *scholars of St Peter the martyr*; and they wore a cross before them on the outside garment. They are properly bailiffs of the inquisition; and the vile office is esteemed so honourable, that noblemen in the kingdom of Portugal have been ambitious of belonging to it. Nor is this surprising, when it is considered that Innocent III. granted very large indulgences and privileges to these familiars; and that the same plenary indulgence is granted by the pope to every single exercise of this office, as was granted by the Lateran council to those who succoured the Holy Land. When several persons are to be taken up at the same time, these familiars are commanded

Family || Fan.

manded to order matters, that they may know nothing of one another's being apprehended; and it is related, that a father and his three ſons, and three daughters, who lived together in the ſame houſe, were carried priſoners to the inquiſition without knowing any thing of one another's being there till ſeven years afterwards, when they that were alive were releaſed by an act of faith.

FAMILY denotes the perſons that live together in one houſe, under the direction of one head or chief manager. It alſo ſignifies the kindred or lineage of a perſon; and is uſed by old writers for a hide or portion of land ſufficient to maintain one family. See HIDE.

FAMILY, in *Natural Hiſtory*, a term uſed by authors to expreſs any order of animals, or other natural productions of the ſame claſs.

FAMINE, dearth, or ſcarcity of food. For preſervatives againſt hunger in times of famine, ſee the article HUNGER.

FAN, a machine uſed to raiſe wind, and cool the air by agitating it.

That the uſe of the fan was known to the ancients is very evident from what Terence ſays,

Cape hoc flabellum, *et ventulum huic ſic facito;*

and from Ovid, Art. Amand. I. 161.

Profuit et tenues ventos moviſſe flabello.

The fans of the ancients were made of different materials; but the moſt elegant were compoſed of peacocks feathers, or perhaps painted ſo as to repreſent a peacock's feather.

The cuſtom which now prevails among the ladies, of wearing fans, was borrowed from the eaſt, where the hot climate renders the uſe of fans and umbrellas almoſt indiſpenſable.

In the eaſt they chiefly uſe large fans made of feathers, to keep off the ſun and the flies. In Italy and Spain they have a large ſort of ſquare fans, ſuſpended in the middle of their apartments, and particularly over the tables: theſe, by a motion at firſt given them, and which they retain a long time on account of their perpendicular ſuſpenſion, help to cool the air and drive off flies.

In the Greek church, a fan is put into the hands of the deacons in the ceremony of their ordination, in alluſion to a part of the deacon's office in that church, which is to keep the flies off the prieſts during the celebration of the ſacrament.

What is called a *fan* amongſt us and throughout the chief parts of Europe, is a thin ſkin, or piece of paper, taffety, or other light ſtuff, cut ſemicircularly, and mounted on ſeveral little ſticks of wood, ivory, tortoiſeſhell, or the like. If the paper be ſingle, the ſticks of the mounting are paſted on the leaſt ornamened ſide: if double, the ſticks are placed betwixt them. Before they proceed to place the ſticks, which they call *mounting the fan*, the paper is to be plaited in ſuch a manner, as that the plates may be alternately inward and outward.

It is in the middle of each plait, which is uſually about half an inch broad, that the ſticks are to be paſted; and theſe again are to be all joined and rivetted together at the other end; they are very thin, and ſcarcely exceed one-third of an inch in breadth; and where they are paſted to the paper, are ſtill narrower, continuing thus to the extremity of the paper. The two outer ones are bigger and ſtronger than the others. The number of ſticks rarely exceeds 22. The ſticks are uſually provided by the cabinetmakers or toymen; the fan-painters plait the papers, paint, and mount them.

Fan || Fanſhaw.

The common painting is either in colours or gold leaf, applied on a ſilvered ground, both prepared by the goldbeaters. Sometimes they paint on a gold ground, but it is rarely; true gold being too dear, and falſe too paltry. To apply the ſilver leaves on the paper, they uſe a compoſition, which they pretend is a great ſecret, but which appears to be no other than gum arabic, ſugar-candy, and a little honey, melted in common water, and mixed with a little brandy. This compoſition is laid on with a ſponge; then laying the ſilver leaves thereon, and preſſing them gently down with a linen ball ſtuffed with cotton, they catch hold, and adhere together. When, inſtead of ſilver, gold ground is laid, the ſame method is obſerved. The ground being well dried, a number of the papers are well beaten together on a block, and by this means the ſilver or gold get a luſtre as if they had been burniſhed.

FAN is alſo an inſtrument to winnow corn. The machine uſed for this purpoſe by the ancients ſeems to have been of a form ſimilar to ours. The fan, which Virgil calls *myſtica vannus Iacchi*, was uſed at initiations into the myſteries of the ancients: For as the perſons who were initiated into any of the myſteries, were to be particularly good, this inſtrument, which ſeparates the wheat from the chaff, was the fitteſt emblem that could be of ſetting apart the good and virtuous from the vicious and uſeleſs part of mankind. It is figuratively applied in a ſimilar manner in Luke iii. 17.

FANATICS, wild, entbuſiaſtic, viſionary perſons, who pretend to revelation and inſpiration.

The ancients called thoſe *fanatici* who paſſed their time in temples (*fana*), and being often ſeized with a kind of enthuſiaſm, as if inſpired by the divinity, ſhowed wild and antic geſtures. Prudentius repreſents them as cutting and ſlaſhing their arms with knives. Shaking the head was alſo common among the fanatici; for Lampridius informs us, that the emperor Heliogabalus was arrived at that pitch of madneſs, as to ſhake his head with the gaſhed fanatics. Hence the word was applied among us to the Anabaptiſts, Quakers, &c. at their firſt riſe, and is now an epithet given to the modern prophets, Muggletonians, &c.

FANCY, or imagination. See IMAGINATION.

FANIONS, in the military art, ſmall flags carried along with the baggage.

FANNERS, a machine for winnowing corn, or for ſeparating the chaff from the grain. See, for its deſcription, MECHANICS.

FANSHAW, SIR RICHARD, famous for his embaſſies and writings, was the tenth and youngeſt ſon of Sir Henry Fanſhaw of Ware Park in Hertfordſhire, where it is ſuppoſed he was born about the year 1607. He diſtinguiſhed himſelf ſo early by his abilities, that in 1635 he was taken into government employments by King Charles I. and ſent reſident to the court of Spain; whence being recalled in the beginning of the troubles

Fantaſia || Farce.

troubles in 1641, he adhered to the royal intereſt, and was employed in ſeveral important matters of ſtate. During his vacant hours he wrote divers poems, and made ſeveral tranſlations. At the Reſtoration it was expected he would have been made one of the ſecretaries of ſtate: however, he was made maſter of the requeſts; a ſtation in thoſe times of conſiderable profit. Afterwards, on account of his ſkill in the Latin language, he was made ſecretary for that tongue. In 1661, he was ſent envoy to the king of Portugal. In 1662, he was again ſent to that court with the title of *ambaſſador*, and negotiated the marriage of his maſter King Charles II. with the infanta Donna Catherina. Upon his return he was made one of the privy council. In 1664, he was ſent ambaſſador to both the courts of Spain and Portugal; at which time the foundation of peace betwixt thoſe crowns and England was laid by him. His conduct during his former employments in thoſe courts gained him ſuch high eſteem there, that his reception was magnificent, exceeding all that were before, which thoſe kings declared was not to be a precedent to ſucceeding ambaſſadors. He died at Madrid in 1666, on the very day he had fixed for ſetting out on his return to England. Beſides ſome original poems, and other tranſlations, he publiſhed a tranſlation of Bathiſta Guarini's *Paſtor Fido*, and another of the *Luſiad* of Camoens. Among his poſthumous publications are, "Letters during his embaſſies in Spain and Portugal; with his life prefixed."

FANTASIA, in the Italian muſic, ſignifies *fancy*; and is uſed for a compoſition, wherein the compoſer ties himſelf to no particular time, but ranges according as his fancy leads, amidſt various movements, different airs, &c. This is otherwiſe called the *capricious ſtyle*: before ſonatas were uſed, there were many of this kind, ſome of which remain even now.

FANUM, among the Romans, a temple or place conſecrated to ſome deity. The deified men and women among the heathens had likewiſe their *fana*; even the great philoſopher Cicero erected one to his daughter Tullia.

Fanum Vacunæ, in *Ancient Geography*, a village of the Sabines, ſituated between Cures and Mandela; where ſtood the temple of Vacuna, goddeſs of the idle or unemployed, in an old decayed ſtate: and hence the epithet *putre*, uſed by Horace. Now called *Vocone*, in the Eccleſiaſtic State.

FARANDMAN, a traveller, or merchant ſtranger, to whom, by the laws of Scotland, juſtice ought to be done with all expedition, that his buſineſs or journey be not hindered.

FARCE, was originally a droll, petty ſhow, or entertainment, exhibited by charletans, and their buffoons, in the open ſtreet to gather the crowd together. —The word is French, and ſignifies literally, "force-meat or ſtuffing." It was applied on this occaſion, no doubt, on account of the variety of jeſts, gibes, tricks, &c. wherewith the entertainment was interlarded. Some authors derive farce from the Latin *facetia*; others from the Celtic *farce*, "mockery;" others from the Latin *farcire*, "to ſtuff."

At preſent it is removed from the ſtreet to the theatre; and inſtead of being performed by merry-andrews to amuſe the rabble, is acted by comedians, and become the entertainment of a polite audience. Poets have reformed the wildneſs of the primitive farces, and brought them to the taſte and manner of comedy. The difference between the two on our ſtage is, that comedy keeps to nature and probability, and therefore is confined to certain laws preſcribed by ancient critics; whereas farce diſallows of all laws, or rather ſets them aſide on occaſion. Its end is purely to make merry; and it ſticks at nothing which may contribute thereto, however wild and extravagant. Hence the dialogue is uſually low, the perſons of inferior rank, the fable or action trivial or ridiculous, and nature and truth everywhere heightened and exaggerated to afford the more palpable ridicule.

Farcia || Farm.

FARCIN, or FARCY, a diſeaſe in horſes, and ſometimes in oxen, &c. ſomewhat of the nature of a ſcabies or mange. See FARRIERY *Index*.

FARDING-DEAL, the fourth part of an acre of land. See ACRE.

FARE, moſt commonly ſignifies the money paid for a voyage, or paſſage by water; but, in London, it is what perſons pay for being conveyed from one part of the town to another in a coach or chair.

FAREWELL-CAPE, the moſt ſoutherly promontory of Greenland, in W. Long. 50°, and N. Lat. 60°

FARIN, or FARM. See FARM.

FARINA, a Latin term ſignifying meal, or the flour of corn. See CORN.

Farina Fœcundans, among *Botaniſts*, the ſuppoſed impregnating meal or duſt on the apices or antheræ of flowers. See POLLEN.

The manner of gathering the farina of plants for microſcopical obſervations is this: Gather the flowers in the midſt of a dry ſunſhiny day when the dew is perfectly off, then gently ſhake off the farina, or lightly bruſh it off with a ſoft hair-pencil, upon a piece of white paper; then take a ſingle talc or iſinglaſs between the nippers, and, breathing on it, apply it inſtantly to the farina, and the moiſture of the breath will make that light powder ſtick to it. If too great a quantity be found adhering to the talc, blow a little of it off; and, if there is too little, breathe upon it again, and take up more. When this is done, put the talc into the hole of a ſlider, and, applying it to the microſcope, ſee whether the little grains are laid as you deſire; and if they are, cover them up with another talc, and fix the ring; but be careful that the talcs do not preſs upon the farina in ſuch a manner as to alter its form.

FARLEU, money paid by the tenants in the weſt of England, in lieu of a heriot. In ſome manors of Devonſhire, farleu is often diſtinguiſhed to be the beſt goods, as heriot is the beſt beaſt, payable at the death of a tenant.

FARM, FARIN, or *Ferm*, *(Firma)*, in *Law*, ſignifies a little country meſſuage or diſtrict, containing houſe or land, with other conveniences; hired, or taken by leaſe, either in writing, or parole, under a certain yearly rent. See LEASE.

This in divers parts is differently termed: in the north, it is a *tack*; in Lancaſhire, *fermeholt*; in Eſſex, a *wike*, &c.

In the corrupted Latin, *firma* ſignified a place incloſed or ſhut in: whence, in ſome provinces, Menage

Farm. obſerves, they call *cloſerie*, or *cloſure*, what in others they call a *farm*. Add, that we find *locare ad firmam*, to ſignify to let to *farm*; probably on account of the ſure hold the tenant here has in compariſon of tenants at will.

Spelman and Skinner, however, chooſe to derive the word *farm* from the Saxon *fearme*, or *feorme*, that is, *victus*, "proviſion;" by reaſon the country people and tenants anciently paid their rents in victuals and other neceſſaries, which were afterwards converted into the payment of a ſum of money. Whence a *farm* was originally a place that furniſhed its landlord with proviſions. And among the Normans they ſtill diſtinguiſh between farms that pay in kind, i. e. proviſions, and thoſe which pay in money; calling the former ſimply *fermes*, and the latter *blanche ferme*, "white ferm."

Spelman ſhows, that the word *firma*, anciently ſignified not only what we now call a *farm*, but alſo a feaſt or entertainment, which the farmer gave the proprietor or landlord, for a certain number of days, and at a certain rate, for the lands he held of him. Thus *fearme* in the laws of King Canute is rendered by Mr Lambard, *victus*: and thus we read of *reddere firmam unius noctis*, and *reddebat unum diem de firma*; which denote proviſion for a night and day, the rents about the time of the conqueſt being all paid in proviſions; which cuſtom is ſaid to have been firſt altered under King Henry I. We alſo ſay *to farm* duties, impoſts, &c.

Culture of a FARM. See AGRICULTURE.

FARM, as connected with gardening, and ſuſceptible of embelliſhment. See GARDENING.

In ſpeculation, it might have been expected that the firſt eſſays of improvement ſhould have been on a farm, to make it both advantageous and delightful; but the fact was otherwiſe: a ſmall plot was appropriated to pleaſure; the reſt was reſerved for profit only. And this may, perhaps, have been a principal cauſe of the vicious taſte which long prevailed in gardens. It was imagined that a ſpot ſet apart from the reſt ſhould not be like them: the conceit introduced deviations from nature, which were afterwards carried to ſuch an exceſs, that hardly any objects truly rural were left within the encloſure, and the view of thoſe without was generally excluded. The firſt ſtep, therefore, towards a reformation, was by opening the garden to the country, and that immediately led to aſſimilating them; but ſtill the idea of a ſpot appropriated to pleaſure only prevailed, and one of the lateſt improvements has been to blend the uſeful with the agreeable; even the ornamental farm was prior in time to the more rural; and we have at laſt returned to ſimplicity by force of refinement.

Of a paſtoral farm. 1. The ideas of paſtoral poetry ſeem now to be the ſtandard of that ſimplicity; and a place conformable to them is deemed a farm in its utmoſt purity. An alluſion to them evidently enters into the deſign of the Leaſowes (A), where they appear ſo lovely as to endear the memory of their author; and juſtify the reputation of Mr Shenſtone, who inhabited, made, and celebrated the place: it is a perfect picture of his mind, ſimple, elegant, and amiable; and will always ſuggeſt a doubt, whether the ſpot inſpired his verſe, or whether, in the ſcenes which he formed, he only realized the paſtoral images which abound in his ſongs. The whole is in the ſame taſte, yet full of variety; and, except in two or three trifles, every part is rural and natural. It is literally a grazing farm lying round the houſe; and a walk, as unaffected and as unadorned as a common field-path, is conducted through the ſeveral encloſures. But for a detail of the plan and ſcenery, as illuſtrative of the preſent ſubject, the reader is referred to the particular deſcription of the Leaſowes publiſhed by the late Mr Dodſley. We ſhall only take notice of one or two circumſtances independent on the general delineation. Farm.

The art with which the diviſions between the fields are diverſified is one of them. Even the hedges are diſtinguiſhed from each other: a common quickſet fence is in one place the ſeparation: in another, it is a lofty hedge-row, thick from the top to the bottom; in a third, it is a continued range of trees, with all their ſtems clear, and the light appearing in the intervals between their boughs, and the buſhes beneath them; in others, theſe lines of trees are broken, a few groupes only being left at different diſtances; and ſometimes a wood, a grove, a coppice, or a thicket, is the apparent boundary, and by them both the ſhape and the ſtyle of the encloſures are varied.

The inſcriptions, which abound in the place, are another ſtriking peculiarity: they are well known and juſtly admired; and the elegance of the poetry, and the aptneſs of the quotations, atone for their length and their number. But, in general, inſcriptions pleaſe no more than once: the utmoſt they can pretend to, except when their alluſions are emblematical, is to point out the beauties, or deſcribe the effects, of the ſpots they belong to; but thoſe beauties and thoſe effects muſt be very faint, which ſtand in need of the aſſiſtance. Inſcriptions, however, to commemorate a departed friend, are evidently exempt from the cenſure; the monuments would be unintelligible without them; and an urn, in a lonely grove, or in the midſt of a field, is a favourite embelliſhment at the Leaſowes: they are indeed among the principal ornaments of the place; for the buildings are moſtly mere ſeats, or little root-houſes; a ruin of a priory is the largeſt, and that has no peculiar beauty to recommend it: but a multiplicity of objects are unneceſſary in the farm; the country it commands is full of them; and every natural advantage of the place within itſelf has been diſcovered, applied, contraſted, and carried to the utmoſt perfection, in the pureſt taſte, and with inexhauſtible fancy.

Among the ideas of paſtoral poetry which are here introduced, its mythology is not omitted: but the alluſions are both to ancient and to modern fables; ſometimes to the fairies; and ſometimes to the naiads and muſes. The objects alſo are borrowed partly from the ſcenes which this country exhibited ſome centuries ago, and partly from thoſe of Arcadia: the priory,

(A) In Shropſhire, between Birmingham and Stourbridge.

Farm. priory, and a Gothic ſeat, ſtill more particularly characteriſed by an inſcription in obſolete language and the black letter, belong to the one; the urns, Virgil's obeliſk, and a ruſtic temple of Pan, to the other. All theſe alluſions and objects are indeed equally rural: but the images in an Engliſh and claſſical eclogue are not the ſame; each ſpecies is a diſtinct imitative character. Either is proper; either will raiſe the farm it is applied to above the ordinary level; and within the compaſs of the ſame place both may be introduced; but they ſhould be ſeparate: when they are mixed, they counteract one another; and no repreſentation is produced of the times and the countries they refer to. A certain diſtrict ſhould therefore be allotted to each, that all the fields which belong to the reſpective characters may lie together, and the correſponding ideas be preſerved for a continuance.

Of an ancient farm. 2. In ſuch an aſſortment, the more open and poliſhed ſcenes will generally be given to the Arcadian ſhepherd; and thoſe in a lower degree of cultivation, will be thought more conformable to the manners of the ancient Britiſh yeomanry. We do not conceive that the country in their time was entirely cleared, or diſtinctly divided; the fields were ſurrounded by woods, not by hedges; and if a conſiderable tract of improved land lay together, it ſtill was not ſeparated into a number of incloſures. The ſubjects, therefore, proper to receive this character, are thoſe in which cultivation ſeems to have encroached on the wild, not to have ſubdued it; as the bottom of a valley in corn, while the ſides are ſtill overgrown with wood; and the outline of that wood indented by the tillage creeping more or leſs up the hill. But a glade of graſs, thus circumſtanced, does not peculiarly belong to the ſpecies; that may occur in a park or paſtoral farm; in this, the paſtures ſhould rather border on a waſte or a common: if large, they may be broken by ſtraggling buſhes, thickets, or coppices; and the ſcattered trees ſhould be beſet with brambles and briars. All theſe are circumſtances which improve the beauty of the place; yet appear to be only remains of the wild, not intended for embelliſhment. Such interruptions muſt, however, be leſs frequent in the arable parts of the farm; but there the opening may be divided into ſeveral lands, diſtinguiſhed, as in common fields, only by different ſorts of grain. Theſe will ſufficiently break the ſameneſs of the ſpace; and the tillage does not furniſh a more pleaſing ſcene, than ſuch a ſpace ſo broken, if the extent be moderate, and the boundary beautiful.

As much wood is eſſential to the character, a ſpot may eaſily be found, where turrets riſing above the covert, or ſome arches ſeen within it, may have the reſemblance of a caſtle or an abbey. The partial concealment is almoſt neceſſary to both; for to accord with the age, the buildings muſt ſeem to be entire; the ruins of them belong to later days: the diſguiſe is, however, advantageous to them as objects; none can be imagined more picturesque, than a tower boſomed in trees, or a cluſter appearing between the ſtems and the branches. But the ſuperſtitions of the times furniſh other objects which are more within compaſs: hermitages were then real; ſolitary chapels were common; many of the ſprings of the country being deemed holy wells, were diſtinguiſhed by little Gothic domes built over them; and every hamlet had its croſs, even this, when perfect, ſet on a little ruſtic pillar, and that raiſed upon a baſe of circular ſteps, may in ſome ſcenes be conſiderable: if a ſituation can be found for a Maypole, whence it would not obtrude itſelf on every view, that alſo might not be improper; and an ancient church, however unwelcome it may be when it breaks into the deſign of a park or a garden, in ſuch a farm as this would be a fortunate accident: nor would the old yew in the church-yard be indifferent; it would be a memorial of the times when it was uſeful. Farm.

Many other objects, ſignificant of the manners of our anceſtors, might perhaps, upon recollection, occur; but theſe are amply ſufficient for a place of conſiderable extent; and cottages muſt abound in every age and every country; they may therefore be introduced in different forms and poſitions. Large pieces of water are alſo particularly proper; and all the varieties of rills are conſiſtent with every ſpecies of farm. From the concurrence of ſo many agreeable circumſtances in this, be the force or the effect of the character what it may, a number of pleaſing ſcenes may be exhibited either in a walk or riding, to be contraſted to thoſe which in another part of the place may be formed on Arcadian ideas; or even to be ſubſtituted in their ſtead, if they are omitted.

Of a ſimple farm. 3. A part may alſo be free from either of theſe imitative characters, and laid out in a common ſimple farm. Some of the greateſt beauties of nature are to be found in the fields, and attend an ordinary ſtate of cultivation: wood and water may there be exhibited in ſeveral forms and diſpoſitions; we may enlarge or divide the incloſures; and give them ſuch ſhapes and boundaries as we pleaſe; every one may be an agreeable ſpot; together, they may compoſe beautiful views; the arable, the paſture, and the mead, may ſucceed one another; and now and then a little wild may be intermixed without impropriety; every beauty, in ſhort, which is not unuſual in an incloſed country, whether it ariſes from neglect or improvement, is here in its place.

The buildings, alſo, which are frequent in ſuch a country, are often beautiful objects; the church and the manſion are conſiderable: the farm-yard itſelf, if an advantageous ſituation be choſen for it; if the ricks, and the barns, and the out-houſes, are ranged with any deſign to form them into groups, and if they are properly blended with trees; may be made a picturesque compoſition. Many of them may be detached from the group, and diſperſed about the grounds: the dove-cote, or the dairy, may be ſeparated from the reſt; they may be elegant in their forms, and placed wherever they will have the beſt effect. A common barn, accompanied by a clump, is ſometimes pleaſing at a diſtance; a Dutch barn is ſo when near; and a hay-ſtack is generally an agreeable circumſtance in any poſition. Each of theſe may be ſingle; and beſides theſe, all kinds of cottages are proper. Among ſo many buildings, ſome may be converted to other purpoſes than their conſtruction denotes; and, whatever be their exterior, may within be made agreeable retreats, for refreſhment, indulgence, or ſhelter.

With ſuch opportunities of improvements, even to decoration within itſelf, and with advantages of proſpect into the country about it, a ſimple farm may undoubtedly be delightful. It will be particularly acceptable

Farm. ceptable to the owner, if it be close to his park or his garden: the objects which constantly remind him of his rank, impose a kind of constraint; and he feels himself relieved, by retiring sometimes from the splendor of a seat into the simplicity of a farm: it is more than a variety of scene; it is a temporary change of situation in life, which has all the charms of novelty, ease, and tranquillity, to recommend it. A place, therefore, can hardly be deemed perfect, which is not provided with such a retreat. But if it be the whole of the place, it seems inadequate to the mansion: a visitor is disappointed; the master is dissatisfied; he is not sufficiently distinguished from his tenants; he misses the appendages incidental to his seat and his fortune; and is hurt at the similarity of his grounds with the country about them. A pastoral or an ancient farm is a little above the common level; but even these, if brought close up to the door, set the house in a field, where it always appears to be neglected and naked. Some degree of polish and ornament is expected in its immediate environs; and a garden, though it be but a small one, should be interposed between the mansion and any species of farm.

Of an ornamented farm. 4. A sense of the propriety of such improvements about a seat, joined to a taste for the more simple delights of the country, probably suggested the idea of an *ornamental farm*, as the means of bringing every rural circumstance within the verge of a garden. This idea has been partially executed very often; but nowhere, perhaps, so completely, and to such an extent, as at Woburn farm, (near Weybridge in Surry.) The place contains 150 acres: of which near 35 are adorned to the highest degree; of the rest, about two thirds are in pasture, and the remainder is in tillage. The decorations are, however, communicated to every part: for they are disposed along the sides of a walk, which, with its appendages, forms a broad belt round the grazing-grounds; and is continued, though on a more contracted scale, through the arable. This walk is properly garden; all within it is farm; the whole lies on the two sides of a hill, and on a flat at the foot of it: the flat is divided into corn-fields; the pastures occupy the hill; they are surrounded by the walk, and crossed by a communication carried along the brow, which is also richly dressed, and which divides them into two lawns, each completely encompassed with garden.

These are in themselves delightful; the ground in both lies beautifully: they are diversified with clumps and single trees; and the buildings in the walk seem to belong to them. On the top of the hill is a large octagon structure; and, not far from it, the ruin of a chapel. To one of the lawns the ruin appears, on the brow of a gentle ascent, backed and grouped with wood; from the other is seen the octagon, upon the edge of a steep fall, and by the side of a pretty grove, which hangs down the declivity. This lawn is further embellished by a neat Gothic building; the former by the house, and the lodge at the entrance; and in both, other objects of less consequence, little seats, alcoves, and bridges, continually occur.

The buildings are not, however, the only ornaments of the walk; it is shut out from the country, for a considerable length of the way, by a thick and lofty hedge-row, which is enriched with woodbine, jessamine, and every odoriferous plant whose tendrils will entwine with the thicket. A path, generally of sand or gravel, is conducted in a waving line, sometimes close under the hedge, sometimes at a little distance from it; and the turf on either hand is diversified with little groups of shrubs, of firs, or the smallest trees, and often with beds of flowers: these are rather too profusely strewed, and hurt the eye by their littleness; but then they replenish the air with their perfumes, and every gale is full of fragrancy. In some parts, however, the decoration is more chaste; and the walk is carried between larger clumps of evergreens, thickets of deciduous shrubs, or still more considerably open plantations. In one place it is entirely simple, without any appendages, any gravel, or any sunk fence to separate it from the lawn; and is distinguished only by the richness of its verdure, and the nicety of its preservation. In the arable part it is also of green sward, following the direction of the hedges about the several inclosures: these hedges are sometimes thickened with flowering shrubs; and in every corner or vacant space, is a rosary, a close or an open clump, or a bed of flowers: but if the parterre has been rifled for the embellishment of the fields, the country has on the other hand been searched for plants new in a garden; and the shrubs and the flowers which used to be deemed peculiar to the one, have been liberally transferred to the other; while their number seems multiplied by their arrangement in so many and such different dispositions. A more moderate use of them would, however, have been better; and the variety more pleasing, had it been less licentious.

But the excess is only in the borders of the walk; the scenes through which it leads are truly elegant, everywhere rich, and always agreeable. A peculiar cheerfulness overspreads both the lawns, arising from the number and the splendor of the objects with which they abound, the lightness of the buildings, the inequalities of the ground, and the varieties of the plantations. The clumps and the groves, though separately small, are often massed by the perspective, and gathered into considerable groups, which are beautiful in their forms, their tints, and their positions. The brow of the hill commands two lovely prospects: the one gay and extensive, over a fertile plain, watered by the Thames, and broken by St Anne's Hill and Windsor Castle; a large mead, of the most luxuriant verdure, lies just below the eye, spreading to the banks of the river; and beyond it the country is full of farms, villas, and villages, and every mark of opulence and cultivation. The other view is more wooded: the steeple of a church, or the turrets of a seat, sometimes rise above the trees; and the bold arch of Walton bridge is there a conspicuous object, equally singular and noble. The inclosures on the flat are more retired and quiet; each is confined within itself; and all together they form an agreeable contrast to the open exposure above them.

With the beauties which enliven a garden are everywhere intermixed many properties of a farm: both the lawns are pastured; and the lowings of the herds, the bleating of the sheep, and the tinklings of the bell-wedder, resound through all the plantations: even the clucking of poultry is not omitted; for a menagerie of a very simple design is placed near the Gothic building;

Farmer. a ſmall ſerpentine river is provided for the water-fowl; while the others ſtray among the flowering ſhrubs on the banks, or ſtraggle about the neighbouring lawn: and the corn fields are the ſubjects of every rural employment which arable land from ſeed-time to harveſt can furniſh. But though ſo many of the circumſtances occur, the ſimplicity of a farm is wanting; that idea is loſt in ſuch a profuſion of ornament; a ruſticity of character cannot be preſerved amidſt all the elegant decorations which may be laviſhed on a garden.

FARMER, he that tenants a farm, or is leſſee thereof. Alſo generally every leſſee for life, years, or at will, is called *farmer*. As this word implies no myſtery, except it be that of huſbandry, huſbandman is the proper addition for a farmer.

FARMER, *Hugh*, an Engliſh clergyman and a man of literature, belonging to the proteſtant nonconformiſts, was deſcended from people of reſpectability in North Wales, and drew his firſt breath at Shrewſbury, in the year 1714. Dr Charles Owen was for ſome time his tutor, and prior to that period he was educated at a ſchool in Llanegrin. His parents from the firſt having deſigned him for the miniſtry, he was ſent to proſecute his ſtudies under the juſtly celebrated Dr Doddridge at Northampton, in 1730. Here, by the rectitude of his conduct and wonderful proficiency, he gained the eſteem of that great man, who always ſpoke of him in the moſt reſpectful terms. Having completed his academical ſtudies, Mr Farmer became the chaplain of William Coward, Eſq. of Walthamſtow, in the county of Eſſex, and was at the ſame time choſen miniſter to a diſſenting congregation in that village. Notwithſtanding the gratitude with which Mr Coward ought to be remembered by many for his charitable inſtitutions, he had certain peculiarities of temper which rendered him a very diſagreeable domeſtic. His doors were ſhut at an uncommonly early hour of the night, and neither viſitor nor conſtant reſident could afterwards obtain admiſſion. Mr Farmer having one evening been detained a little beyond that hour, found the doors ſhut againſt him, and was under the neceſſity of applying to a William Snell, Eſq. ſolicitor, a man of eminence, and poſſeſſed of many excellent qualifications, in whoſe family he remained for 30 years, living in the greateſt friendſhip and intimacy. In this gentleman's houſe he gradually prepared thoſe valuable treatiſes and diſſertations which were afterwards given to the public, and acquired him ſo much celebrity as a man of letters. He alſo continued to diſcharge the duties of his miniſterial function to the people of Walthamſtow.

When a day of thankſgiving was appointed for the fortunate ſuppreſſion of the rebellion in 1745, Mr Farmer preached a ſermon on that occaſion which was publiſhed the following year. His next work was of conſiderably greater importance, and was entitled, "An Inquiry into the Nature and Deſign of our Lord's temptation in the wilderneſs." 8vo. In this work it was the deſign of Mr Farmer to prove that the whole was tranſacted in viſion, the different ſtages of which were intended to point out to him the difficulties and duties of his ſubſequent miniſtry. The originality of thought and profound erudition which this work diſplayed, ſoon gave it a very extenſive circulation, and called forth the exertions of thoſe who were of an oppoſite opinion. It received one reply under the title of "Chriſt's temptations real facts," which poſſeſſed conſiderable merit, Farmer. but much inferior to Mr Farmer's for energy of expreſſion, depth of thinking, and force of argument. But the moſt maſterly, perhaps, of all Mr Farmer's literary productions, was his "Diſſertation on Miracles, deſigned to ſhew that they are arguments of a divine interpoſition, and abſolute proofs of the miſſion and doctrine of a prophet." Some have believed, and perhaps not without reaſon, that this work has no proper rival, notwithſtanding the many able treatiſes upon that ſubject which have made their appearance in different ages. It was firſt publiſhed in the year 1771. But as great talents are frequently envied, and as this infernal principle is the prolific ſource of calumny and detraction, ſo this ſupereminent work of Mr Farmer was declared to have been chiefly borrowed from Mr le Moine on the ſame ſubject;—a ſlander which Mr Farmer refuted in a very able and ſatisfactory manner. In the year 1775, he publiſhed his celebrated "Eſſay on the Demoniacs of the New Teſtament," which may be conſidered as a maſterly completion of the deſign he had in view by his diſſertation on miracles. The hypotheſis he adopted had been formerly defended with great ability by Mede, Sykes, Lardner, and others; but it was reſerved for the critical acumen of Mr Farmer to free it completely from thoſe difficulties which ſtill hung around it. His eſſay on demoniacs was ſucceſſively attacked by Dr Worthington and Mr Fell, both of them men of conſiderable erudition, but much inferior to their able antagoniſt.

Mr Farmer having continued for ſeveral years the ſole paſtor of the congregation at Walthamſtow, an able colleague was appointed him in 1761, in conſequence of which he became the afternoon preacher to the congregation of Salter's-hall, in the city of London, and ſoon after the Tueſday lecturer at the ſame place. He reſigned his miniſterial employments as he advanced in years, which the people commited to his charge very much regretted. In the year 1785 his eyes gave him very much trouble, of the ſight of which he was nearly deprived, but by means of a ſurgical operation, he was for ſome time enabled to reſume his ſtudies. But mortality is the inevitable lot of all men, and the growing infirmities of Mr Farmer brought him to the grave in 1787, in the 73d year of his age.

By his laſt will he had ordered all his manuſcripts to be burnt after his death, a circumſtance which men of letters have juſt reaſon to lament. It is no doubt the duty of executors to pay attention to the will of the deceaſed; yet for the benefit of the Chriſtian world they would have been juſtified in taking a certain latitude in the explanation of his meaning; as it does by no means appear probable that he meant to conſign to the flames his manuſcript entitled, "A Diſſertation on the ſtory of Balaam," which appeared written in a fair hand, as if manifeſtly intended for the preſs. When we ſay that Mr Farmer was a conſummate ſcholar, we truſt that his numerous and able works will fully juſtify the aſſertion; and his talents as a preacher were equally conſpicuous. His voice was remarkable for its clearneſs and harmony, and his whole manner was peculiarly impreſſive. His piety was not moroſe, his converſation was lively, and his whole deportment was a beautiful tranſcript of his moral injunctions.

FARMER, *Richard*, D. D. a ſcholar and critic of conſiderable

Farmer. considerable eminence, was the ſon of a hoſier at Leiceſter, at which place he was born in the year 1735. Here he received the rudiments of his education, and was afterwards a ſtudent at Cambridge, and penſioner of Emanuel college. He was conſidered as a young man well acquainted with books, was much eſteemed among his friends, and looked upon as poſſeſſed of lively parts, even before he acquired any extraordinary reputation as a ſcholar. He was made B. A. in 1757, and M. A. in 1760. Seven years after this period, having been for ſome time a curate, he took the degree of B. D. and became a preacher at Whitehall. Beſides the attention he paid to the Grecian and Roman authors, he proſecuted the ſtudy of books in his own language, printed on black-letter, which laid the foundation of a work that added more to his literary reputation than any other performance. This was "An Eſſay on the learning of Shakeſpeare," which he publiſhed in 1766. Men of letters had long turned their attention to the learning of Shakeſpeare, in order to aſcertain its real extent. It could not be queſtioned that he was acquainted with the hiſtory and mythology of the ancients, but it was ſtill a matter of diſpute from what ſources that acquaintance was derived. To obviate this difficulty, Mr Farmer's knowledge of books enabled him to demonſtrate, that tranſlations of the far greater part of claſſical authors were to be met with in the time of the celebrated dramatiſt; and as he proved that Shakeſpeare had even copied the blunders and errors of ſuch tranſlations, he made it manifeſt beyond the poſſibility of a rational doubt, that he was wholly incapable of conſulting the originals. This eſſay paſſed through three editions in a very ſhort time; was much admired for the ſprightlineſs of its compoſition, and the generality were perſuaded that he had fully eſtabliſhed his point.

This performance brought him ſo much into notice, as to become extremely favourable to his profeſſional advancement. By the influence of Biſhop Hurd, he procured the chancellorſhip and a prebend in the cathedral of Lichfield, and in 1755 he was elected maſter of Emanuel college, and took the degree of D. D. He was ſoon after conſtituted principal librarian to the univerſity, and ſerved in turn the office of vice-chancellor. He was made prebendary of Canterbury by Lord North, at that time prime miniſter, and Mr Pitt made him twice an offer of a biſhopric; but the conſtraints and ſolemnity of the epiſcopal character were not congenial to his natural temper, on which account he declined the offer, and having reſigned his office as prebendary, he accepted of a reſidentiaryſhip of St Paul's. This obliged him to reſide three months annually in London, which he ſpent with pleaſure and advantage in the company of literary characters. From nature he inherited a fund of good humour, and was of ſuch an obliging turn, that he buried party ſpirit in the ſatisfaction which he found in the performance of beneficent actions. Though in general an enemy to reforms of any kind, and anxious to preſerve *things as they were*, both in church and ſtate, he was inſtrumental in amending the police of Cambridge, eſpecially as it related to the paving and lighting of the ſtreets. At his inſtigation alſo, monumental ſculpture was admitted into the cathedral of St Paul's, which will continue to exhibit a ſtriking proof of national gratitude, and ſerve to cover the nakedneſs of the walls.

It was at one time the intention of Dr Farmer to publiſh a hiſtory of the town and antiquities of Leiceſter, the expences to be defrayed by ſubſcription; but either his independent circumſtances, or a degree of native indolence, made him relinquiſh the deſign, and the few materials he had collected were given to Mr John Nichols, at that time engaged in an elaborate work on the ſame ſubject. After a painful illneſs of ſome length, Dr Farmer died at Emanuel college in the month of September, 1797, in the 62d year of his age. Dr Parr wrote an epitaph for his tombſtone, in which we find the following teſtimony to his worth. "Vir facetus et dulcis, feſtique ſermonis, Græcè et Latinè doctus, in explicanda veterum Anglorum poëſi ſubtilis et elegans." He had a conſiderable library, in which were a vaſt number of books purchaſed at the ſtalls of London, and afterwards diſpoſed of for much more than they coſt. Farmer || Farnabie.

FARMER, in mining, is the lord of the field, or one that farms the lot and cope of the king.

FARN ISLANDS, two groups of little iſlands and rocks, 17 in number, lying oppoſite to Bamborough caſtle in Northumberland. At low water the points of ſeveral others are viſible beſides the 17 juſt mentioned. The neareſt iſland to the ſhore is called the *Houſe-iſland*, and lies exactly one mile and 68 chains from the coaſt. The moſt diſtant is about ſeven or eight miles. Their produce is kelp, feathers, and a few ſeals, which the tenant watches and ſhoots for the ſake of the oil and ſkins. Some of them yield a little graſs that may ſerve to feed a cow or two; which the people tranſport over in their little boats. The largeſt or Houſe-iſland is about one mile in compaſs, and has a fort and a lighthouſe. It contains about ſix or ſeven acres of rich paſture; and the ſhore abounds with good coals which are dug at the ebb of tide. St Cuthbert is ſaid to have paſſed the two laſt years of his life on this iſland. A priory of Benedictines was afterwards eſtabliſhed here, for ſix or eight monks, ſubordinate to Durham. A ſquare tower, the remains of a church, and ſome other buildings, are ſtill to be ſeen on this iſland; and a ſtone coffin, which is pretended to be that of St Cuthbert. At the north end of the iſle is a deep chaſm, from the top to the bottom of the rock, communicating with the ſea; through which, in tempeſtuous weather, the water is forced with great violence and noiſe, and forms a fine jet d'eau of 60 feet high. It is called by the inhabitants of the oppoſite coaſt, the *Churn*. One of the iſlands in the moſt diſtant group is called the *Pinnacles*, from ſome vaſt columnar rocks at the ſouth end, even at their ſides, flat at the tops, and entirely covered with guillemots and ſhags. The fowlers paſs from one to the other of theſe columns by means of a board, which they place from top to top, forming a narrow bridge over ſuch a dreadful gap that the very ſight of it ſtrikes one with horror.

FARNABIE, THOMAS, ſon of a carpenter at London, born in 1575, ſtaid a ſhort while at Oxford; where being enticed to abandon his religion, he went to Spain, and was there educated in a college belonging to the Jeſuits. Being weary of their ſevere diſcipline, he went with Sir John Hawkins and Sir Francis Drake in their laſt voyage in 1595. He was afterwards a ſoldier in the Low Countries: but being reduced

Farnham, Farnovians.

ced to great want, returned to England, where wandering about for ſome time under the name of *Thomas Bainrafe*, the anagram of his name, he ſettled at Mattock in Somerſetſhire, and taught a grammar-ſchool with good reputation. He removed to London, and opened a ſchool with large accommodations for young gentlemen. While he taught this ſchool, he was made maſter of arts at Cambridge, and incorporated into the univerſity of Oxford. Thence he removed, in 1636, to Seven-oaks in Kent; and taught the ſons of ſeveral noblemen and gentlemen, who boarded with him, with great ſucceſs, and grew rich. His works gained him reputation. Upon the breaking out of the civil commotions in 1641, he was caſt into priſon. It was debated in the houſe of commons, whether he ſhould be ſent to America; but this motion being rejected, he was removed to Ely-houſe in Holborn, and there he died in 1647. Mr Farnabie was a very eminent grammarian; and many writers have ſpoken with great approbation of his labours. M. Bayle in particular ſays, "His notes upon moſt of the ancient Latin poets have been of very great uſe to young beginners; being ſhort, learned, and deſigned chiefly to clear up the text."

FARNHAM, or FERNHAM; a town of Surry, and capital of the hamlet of its own name, 41 miles from London on the Wincheſter road. It is a large populous place, ſituated on the river Wey, and ſuppoſed to have its name from the fern which abounded here. It was given by the Weſt Saxon king Ethelbald to the ſee of Wincheſter; the biſhops of which have generally reſided in the caſtle here, in the ſummer time, ever ſince the reign of King Stephen, whoſe brother, its then biſhop, firſt built it. It was a magnificent ſtructure, with deep moats, ſtrong walls and towers at proper diſtances, and a fine park; but it is much decayed. The town, which has many handſome houſes, and well paved ſtreets, is governed by 12 maſters or burgeſſes, of whom two are bailiffs, (choſen annually). They have the profit of the fairs and markets, and the aſſize of bread and beer; and hold a court every three weeks, which has power of trying and determining all actions under 40s. From Michaelmas to Chriſtmas here is a good market for oats; and one of the greateſt wheat markets in England, eſpecially between All-Saints day and mid-ſummer. The toll-diſh here was once reckoned worth 200l. a-year; but it is much diminiſhed, ſince the people about Chicheſter and Southampton began to ſend their meal to London by ſea. But this loſs is amply made up by the vaſt growth of hops here, of which there are 300 or 400 acres of plantations about this town, and they are ſaid to outdo the Kentiſh hop-yards both in quantity and quality. This town ſent members to parliament in the reign of Edward II. but never ſince. The magiſtrates have their privileges from the biſhop of Wincheſter, to whom they pay an acknowledgment of 12d. a-year. The market is on Thurſday: fairs, Holy Thurſday, June 24 and November 2. Here are a free ſchool, and a great market for Welſh hoſe.

FARNOVIANS, in eccleſiaſtical hiſtory, a ſect of Socinians, ſo called from Staniſlaus Farnovius, who ſeparated from the other Unitarians in the year 1568, and was followed by ſeveral perſons eminent for their learning. This ſect did not laſt long; for having loſt their chief, who died in 1615, it was ſcattered abroad and reduced to nothing. Farnovius was engaged by Goneſius to prefer the Arian ſyſtem to that of the Socinians, and conſequently aſſerted, that Chriſt had been produced out of nothing by the Supreme Being before the creation of this terreſtrial globe. His ſentiments concerning the Holy Ghoſt are not certainly known; however, it appears that he warned his diſciples againſt paying the tribute of religious worſhip to the Divine Spirit. Farquhar

FARQUHAR, GEORGE, an ingenious poet and dramatic writer, the ſon of a clergyman in Ireland, was born at Londonderry in 1678. He was ſent to Trinity College, Dublin; but his volatile diſpoſition not reliſhing a college life, he betook himſelf to the ſtage; where, having dangerouſly wounded a brother-actor in a tragic ſcene, by forgetting to change his ſword for a foil, it ſhocked him ſo much that he left the Dublin theatre and went to London. Here he procured a lieutenant's commiſſion by the intereſt of the earl of Orrery; which he held ſeveral years, and gave many proofs both of courage and conduct. In 1698, he wrote his firſt comedy called Love and a Bottle; which, for its ſprightly dialogue and buſy ſcenes, was well received. In the beginning of the year 1700, which was the jubilee year at Rome, he brought out his Conſtant Couple, or a Trip to the Jubilee: and ſuited Mr Wilks's talents ſo well in the character of Sir Harry Wildair, that the player gained almoſt as much reputation as the poet. This tempted him to continue it in another comedy called Sir Harry Wildair, or The ſequel of the Trip to the Jubilee; in which Mrs Oldfield acquired great applauſe. In 1702, he publiſhed his Miſcellanies, which contain a variety of humorous ſallies of fancy. In 1703, appeared the Inconſtant, or the Way to Win him: in 1704, a farce called the Stage-coach; in 1705, The Twin Rivals; and in 1706, the Recruiting Officer, founded on his own obſervations while on a recruiting party at Shrewſbury. His laſt comedy was the Beaux Stratagem, of which he did not live to enjoy the full ſucceſs. Mr Farquhar married in 1703. Before that time his manner of life had been rather diſſipated. The lady, therefore, who afterwards became his wife, having fallen violently in love with him, but judging that a gentleman of his humour would not eaſily be drawn into the trammels of matrimony, contrived to have it given out that ſhe was poſſeſſed of a large fortune; and finding means afterwards to let Mr Farquhar know her attachment to him, intereſt and vanity got the better of his paſſion for liberty, and the lady and he were united in the hymeneal bands. But how great was his diſappointment, when he found all his proſpects overclouded ſo early in life (for he was then no more than 24), by a marriage from which he had nothing to expect but an annual increaſe of family, and an enlargement of expence in conſequence of it far beyond what his income would ſupport. Yet, to his honour be it told, though he found himſelf thus deceived in a moſt eſſential particular, he never was known once to upbraid his wife with it; but generouſly forgave an impoſition which love for him alone had urged her to, and even behaved to her with all the tenderneſs and delicacy of the moſt indulgent huſband. Mrs Farquhar, however, did not very long enjoy the happineſs ſhe had purchaſed by this ſtratagem; for the circumſtances that attended this union were in ſome reſpect perhaps the means

Farquhar. means of ſhortening the period of the captain's life. For, finding himſelf conſiderably involved in debt in conſequence of their increaſing family, he was induced to make application to a certain noble courtier, who had frequently profeſſed the greateſt friendſhip for him, and given him the ſtrongeſt aſſurances of his intended ſervices. This pretended patron repeated his former declarations; but, expreſſing much concern that he had nothing at preſent immediately in his power, adviſed him to convert his commiſſion into money to anſwer his preſent occaſions, and aſſured him that in a ſhort time he would procure another for him. Farquhar, who could not bear the thoughts of his wife and family being in diſtreſs, followed this advice, and ſold his commiſſion; but, to his great mortification and diſappointment, found, on a renewal of his application to this inhuman nobleman, that he had either entirely forgotten, or had never intended to perform, the promiſe he had made him. This diſtracting fruſtration of all his hopes fixed itſelf ſo ſtrongly on our author's mind, that it ſoon brought on him a ſure, though not a very ſudden, declenſion of nature, which at length carried him off the ſtage of life in 1707, before he arrived at 30 years of age.—His comedies are ſo diverting, and the characters ſo natural, that his plays ſtill continue to be repreſented to full houſes. Farrier.

FARRIER, one whoſe employment is to ſhoe horſes, and cure them when diſeaſed or lame.

FARRIERY.

INTRODUCTION.

Origin of the term farriery.

THE term *farrier* is probably a corruption of *ferrier*, Fr. *ferrans*, from the verb *ferrer*, *to ſhoe a horſe*; all theſe words being derived from the Latin *ferrum*, "*iron*." There is no doubt that the word *farrier* was at firſt uſed to denote a perſon who ſhod horſes, but as theſe perſons were for a long period the only *horſe-doctors*, the term was ſoon uſed in the more extenſive ſenſe of *horſe-doctor* or *horſe-leech*; and hence *farriery* came to ſignify the *art of curing the diſeaſes of horſes*.

There can be little doubt that the word *farrier* was originally ſpelt *ferrier* or *ferrer*; as we meet with this latter orthography in ſome of our older writers. Thus Blundeville, who wrote in the time of Queen Elizabeth, in his "Addreſs to the Gentlemen of England," book iv. has the following ſentence.

"All horſes, for the moſt part, do come into their decay, ſooner than they ſhould do, by one of theſe four waies; that is to ſay, either for lacke of being well bred, or through the raſhneſs of the rider, the negligence of the keeper, or elſe through the unſkilfulneſſe of the *ferrer*."

Again, the ſame author mentions, "Martin Ghelly of Aſton, called Martin Alman, chiefe *ferrer* to the queen's magiſtie."

2 Veterinary art.

Farriery, in the uſual acceptation of the word, forms only a part of that more general art, which has been commonly called the *veterinary art*; by which is underſtood the art of medicine as applied to the inferior animals, which has been long called by the French *l' art veterinaire*, or *medicine veterinaire*. This word *veterinary* is of very ancient date, being derived from the Latin *veterinarius*, which is uſed by Columella to denote a *horſe-doctor*, or *cattle-doctor*. The term *veterinary*, being derived from *veterinus*, qu. *veheterinus*, à *vehendo*, *carrying*, is properly applicable only to beaſts of burden; but *veterinary medicine* is now commonly employed in a more comprehenſive ſenſe, to denote the art of curing the diſeaſes of *domeſtic animals* in general.

3 Term extended.

The French, who appear to have firſt uſed the term in this general ſenſe, uſually diſtinguiſh that part of the art which we call *farriery* by the appellation of *Hippiatrique*, from *ἱππος*, *a horſe*, and *ἰατρος*, *phyſician*. Thus, they have a *Cours d'Hippiatrique*, a *Dictionaire d'Hippiatrique*, &c.

As there are conſiderable advantages attending the conſideration of the diſeaſes of the ſeveral domeſtic animals in the ſame treatiſe, we propoſe, in the preſent article, not to confine ourſelves to the medical treatment of the horſe, but to extend our views to the diſeaſes of ſuch other of the domeſtic animals, as are of moſt importance to man, particularly the ox, ſheep, and dog.

The diſeaſes of the horſe, as they are better known, and more intereſting, than thoſe of the other domeſtic animals, will of courſe occupy the greateſt ſhare of our attention. The diſeaſes of the dog have been as yet too little inveſtigated for us to give a very ſatisfactory account of them; but as the ſubject of veterinary medicine has of late been much cultivated, it is probable that theſe, as well as ſome other obſcure diſeaſes of animals, may ere long receive ſome elucidation. If any conſiderable improvements or diſcoveries ſhall be made before the completion of our work, we ſhall notice them under VETERINARY medicine.

4 Objections anſwered.

It may be thought, that, conſidering veterinary medicine in this extenſive point of view, it would have been more correct to defer the ſubject to the article VETERINARY; but moſt of our readers who have been accuſtomed to ſee in our dictionary the article FARRIERY, will expect an account of, at leaſt, the diſeaſes of the HORSE, under this article, and would probably not be pleaſed to have this delayed till nearly the end of the work; beſides, it is of little importance under which article the diſeaſes of animals are treated of, as, when we have once defined our terms, we cannot be miſunderſtood, provided we always employ them in the ſenſe of the definition. Again, as the term *veterinary* has departed from its original ſignification, there can be no objection to our employing the word *farriery*, a term that is more familiar, in the ſame general ſenſe. In fact, it has been ſo employed by a late writer on the ſubject, Mr Feron, who has entitled his work, "A new Syſtem of Farriery," though he profeſſes to treat in it of the horſe, ox, and ſheep.

In this article, then, we ſhall uſe *farriery* as ſynonymous with *veterinary art*, and ſhall conſider both as

the

Introduction.

the art of preſerving the health and curing the diſeaſes of domeſtic animals.

5 Importance of the ſubject

The ſtudy of veterinary medicine muſt be an intereſting object to every perſon, whoſe profeſſion, or ſituation in ſociety, requires him to attend to the comforts and diſeaſes of domeſtic animals.

6 To the veterinary practitioner.

To the *veterinary practitioner*, the ſtudy of the principles of his art, the hiſtory of the diſeaſes which he is called on to relieve, and the methods of treating them that have been found moſt ſucceſsful, are as eſſential, as the ſtudy of the human economy, and the diſeaſes to which it is expoſed, are to the medical practitioner. A farrier who has ſtudied his art ſcientifically, is as much ſuperior to the ignorant empiric, to whoſe mercy the lives and limbs of horſes and cattle are uſually intruſted; as the regular phyſician to the illiterate quack, who puffs off his pernicious noſtrums in every newſpaper, and enriches himſelf, by impoſing on the credulity and folly of the public. The neceſſity of a regular education to the farrier, as well as to the ſurgeon or phyſician, which had long been ſeen, has led to the inſtitution of veterinary ſchools; at firſt in France, and within theſe few years in England. Of theſe we ſhall preſently give an account.

7 To the farmer and country gentleman.

To the *farmer* and *country gentleman* this ſubject muſt be highly intereſting. They will find their account in being able *themſelves* to ſuperintend the management of their horſes, dogs, ſheep, and cattle, ſo as beſt to preſerve their health, and relieve their diſeaſes, without relying implicitly on their grooms, huntſmen, and farriers, herdſmen and cattle-doctors, who are probably either notoriouſly ignorant, or are induced from intereſted views, or a fellow-feeling, to prolong the cure, and pick the pockets of their maſters (A). Theſe gentlemen therefore cannot employ a part of their leiſure time to greater advantage than in acquiring a knowledge of the diſeaſes of domeſtic animals.

8 To the medical practitioner.

The *medical* practitioner who wiſhes to derive an advantage from analogy in ſome of the obſcure diſeaſes to which the human frame is ſubject, and which would probably receive conſiderable elucidation from a compariſon with ſimilar diſeaſes that affect the inferior animals, muſt engage with peculiar intereſt, in a reſearch that promiſes ſo well to repay his labour. "It is not a little remarkable, (ſay the editors of a well-conducted medical journal), that the diſeaſes of horſes, cattle, and ſheep, which occur ſo frequently, and are ſo ſeriouſly lamented, ſhould be ſo imperfectly underſtood. No greater benefit could be conferred on phyſical ſcience than a complete hiſtory of the diſeaſes of our domeſtic animals, eſpecially if given by any one endowed by nature with ſuperior acuteneſs, and a talent for obſervation, improved by habit and experience; who could deſcribe the ſymptoms and appearances of the different diſorders, point out the analogies with thoſe incident to the human body, detect thoſe minute circumſtances which ſerve to diſtinguiſh them, claſs them under their proper heads, and correct all the confuſion in which they now lie involved. Veterinary medicine has lately occupied ſome ſhare of attention, chiefly as relating to horſes, and as a diſtinct purſuit from the general ſtudy of all the diſeaſes of animals, but conſidered apart from any relation or inquiry concerning the treatment of the morbid ſtates of the human ſyſtem. It is in this laſt point of view, that comparative pathology ſeems to offer ſo many ſubjects worthy inveſtigation; and, when looked upon in this light, it ſtrikes us as one of thoſe ſtudies *quæ ad nos pertinent, et quæ neſcire malum eſt**.

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* *Edin. Med. and Sur. Journ.* v. i. p. 440.

9 Farriery much indebted to medical men.

We ſhall ſee, from the hiſtorical ſketch of farriery, which will immediately be given, that the art never made any conſiderable progreſs, or aſſumed any thing like a ſcientific form, till it attracted the attention of men who had made the *human* economy their ſtudy. Almoſt the only rational improvements, that have been made in the art, were either ſuggeſted or carried into effect by medical men; and nothing will contribute ſo much to its perfection as the intereſt which the profeſſion has lately ſhewed to it, and the attention that has of late been paid to the ſtudy of comparative anatomy and pathology.

10 Analogy between the diſeaſes of man and of animals.

The healing art in general muſt profit by this. There is not only an intimate connection between the ſtructure of man and that of the inferior animals; but, eſpecially in thoſe that have been domeſticated, the diſeaſes of both are nearly allied.

The murrains, that in the early part of the laſt century ſo frequently attacked the horned cattle throughout almoſt all Europe, nearly depopulating moſt of the farms, are very analogous to ſome of the epidemic diſeaſes of man; and peſtilential diſeaſes among cattle, have not unfrequently been the forerunners of ſimilar epidemics among the human race. Homer, in deſcribing the plague that haraſſed the Grecian camp, in conſequence of the affront given by Agamemnon to the prieſt of Apollo, ſays that the domeſtic animals were firſt affected.

Οὐρῆας μὲν πρῶτον ἐπῴχετο, καὶ κύνας ἀργούς,
Αὐτὰρ ἔπειτ' αὐτοῖσι βέλος ἐχεπευκὲς ἔφιεις,
Βαλλ'—— *Il.* i. 50.

"On mules and dogs th' infection firſt began,
"And laſt the vengeful arrows fix'd in man."
POPE.

The plague of boils that raged among the Egyptians (Exod. ix. 10.) affected both man and beaſt. Similar inſtances are related both by ſacred and profane hiſtorians.

Almoſt the whole tribe of inflammations, even the gout (according to Van Swieten), are found to affect the domeſtic animals, are produced by the ſame cauſes, and

(A) It may be thought by ſome, that we have gone too far in accuſing the farriers and grooms, &c. of having a fellow-feeling; but, when it is known, that "a part of every ſhilling paid to common farriers, is in ſome ſhape returned to the groom, as a fee or perquiſite;" that "the ſervant receives at leaſt five per cent. from the farrier on every bill paid by his maſter;" and that "if a horſe dies under the care of a farrier, he generally becomes the property of the groom;" (See Veterinary Tranſactions, N° 1. Introduction); it will be allowed that there is ſome ground for the ſurmiſe.

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and yield to the ſame treatment as in the human ſyſtem.

Domeſtic animals are ſubject to eruptive diſeaſes, both chronic, and ſuch as are attended with fever; and both are very ſimilar to thoſe by which man is affected. It is pretty certain that the ſmallpox ſometimes rages among ſheep, as we ſhall ſee hereafter; and a complaint very like the meaſles often attacks ſwine. Some of them are transferable to man; and to this transference in the caſe of the cowpox, a bleſſing which will render immortal the name of JENNER, we owe the probable annihilation of one of the moſt dreadful peſts that ever affected the human race.

Scrofula and conſumption attack monkeys. Apoplexy, epilepſy, and many others of what are called *nervous* diſeaſes, indigeſtion, and even mental derangement, are not uncommon among domeſtic animals; ſpaſmodic affections are very frequent among them, and it is ſaid, that for one caſe of *tetanus* or *locked jaw* among the human ſpecies in theſe climates, there are ten or twenty among horſes.

The analogy might be purſued much farther; but what has been ſtated is ſufficient to ſhew the advantages that medical men may derive from the ſtudy of veterinary medicine. Many obſcure and dangerous diſeaſes may thus in time be illuſtrated or mitigated; and the effect of doubtful remedies may be aſcertained by experiments on the inferior animals. For, though there are a few inſtances of different effects following the exhibition of the ſame medicines in man and animals; yet, on the whole, the analogy is nearly as complete with reſpect to remedies as diſeaſes (B).

11 A farrier ſhould be acquainted with medicine.

It will appear, from what has been ſaid, that the reaſoning, and much of the treatment, in the diſeaſes of animals muſt be nearly the ſame as in man, and, of courſe, that the veterinary practitioner will gain much by acquiring a knowledge of human medicine. Were the practitioners in farriery generally inſtructed in the principles of medicine, little more would be required, in a treatiſe on farriery, than to point out the difference in the ſtructure and functions of domeſtic animals, to deſcribe the diſeaſes peculiar to theſe, and to mark the varieties that it is neceſſary to obſerve in the treatment of diſeaſe and the adminiſtration of remedies. But, as many of theſe gentlemen have not the opportunity of attending medical lectures, and moſt of them have not received an education that would enable them to underſtand the language in which medical writings are uſually compoſed; it becomes neceſſary in a treatiſe of this kind to accommodate the language to the taſte and capacity of general readers, and to introduce much that will be found in other articles on ſubjects connected with medicine. To prevent repetition, as much as poſſible, and to avoid ſwelling this article to a greater length than is neceſſary, we ſhall, however, where the ſimilarity of the ſubject will admit of it, occaſionally refer to ſome of the medical articles in this dictionary.

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12 Knowledge requiſite for the veterinary practitioner.

The ſucceſsful practice of farriery, like that of medicine in general, requires that the practitioner ſhould poſſeſs a conſiderable ſhare of knowledge. It is not ſufficient to have been long in the habit of managing horſes and cattle; this indeed, to a perſon of a ſtrong mind, and attentive obſervation, will furniſh a conſiderable number of facts, with reſpect to the ſymptoms and progreſs of the diſeaſes to which domeſtic animals are ſubject. But, to mark the minute differences between ſuch as reſemble each other, to inveſtigate their cauſes, and to contrive a rational mode of treatment, requires a much greater ſhare of abilities, and much more extenſive information, than we can expect to find among grooms and ſhepherds, or falls to the lot of moſt of thoſe, who call themſelves farriers and cattle-doctors.

13 Anatomy and phyſiology.

It muſt be obvious to every thinking mind, that no practice either in medicine or farriery can be rational, but ſuch as is founded on a comprehenſive knowledge of the ſtructure and functions of thoſe animals, the treatment of whoſe diſeaſes is the object of that practice. The firſt thing, therefore, neceſſary to the veterinary practitioner is, to acquire ſome idea of the anatomical ſtructure of the domeſtic animals. We have already, in the ſecond part of the article ANATOMY, given a general account of the ſtructure of quadrupeds; and in exemplifying this, in the chapter on *the anatomy of a dog*, we pointed out the moſt ſtriking peculiarities that are to be found in this animal; as we have done with reſpect to ruminating animals, viz. the cow and ſheep, in the ſucceeding chapter of that part. To that article we muſt refer our readers for the anatomical part of our ſubject, as far as relates to the ox, the ſheep, and the dog. It will naturally be expected, that a deſcription of the ſtructure of the horſe ſhould be given in this article; but this deſcription muſt, in general, be conciſe, as the nature of our plan prevents us from enlarging on the ſubject, excepting in thoſe parts where a pretty minute knowledge appears to be neceſſary.

Thoſe who wiſh to ſtudy the anatomy of the horſe minutely, may conſult Vitet's Medicine Veterinaire, tom. 1.; Blaine's Outlines, and Stubb's elegant work on the anatomy of the horſe.

The practitioner ſhould take every opportunity of inſpecting the bodies of thoſe animals that die of diſeaſes, which are very important, or which are not very well underſtood. Morbid diſſections often throw conſiderable light on the nature and treatment of diſeaſes; and it fortunately happens, that with reſpect to domeſtic animals, theſe diſſections are very eaſy, and are not obſtructed by thoſe abſurd prejudices, which, eſpecially in this country, are oppoſed to the diſſection of human bodies. In treating of the diſeaſes of domeſtic animals, in

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(B) One of the moſt remarkable caſes of anomaly in the effect of remedies is that of arſenic, which, in the quantity of a few grains will prove a deadly poiſon to man and moſt animals, but may be given with impunity to horſes to the amount of two drams or more. The ſtory of the different effects of *antimony*, on hogs and *monks*, is well known. See ANTIMONY. As to the example of *white vitriol*, (ſulphate of zinc), which proves emetic in the human ſubject, but produces no ſuch effect in the horſe; it is owing to the different ſtructure of the ſtomach in this animal, by which he is incapable of vomiting. Colocynthis, or *bitter apple*, is well known to be a moſt violent purgative to *man*, but in the *horſe* it has produced no effect, in the enormous doſe of *four ounces*.

Introduction. a future part of this article, we shall give a concise view of the appearances on dissection, as far as they have been ascertained, whenever they tend to illustrate the nature, causes, or treatment of the disease under consideration.

The study of the functions of domestic animals ought to go hand in hand with that of their structure; and the student will find it of considerable advantage, to compare the functions of these animals with those of man. This comparative view will be given in some future article. In the present treatise, we can only speak of the functions of domestic animals, as far as it is necessary to illustrate the nature or the treatment of their diseases.

14 Natural history. The natural history of these animals ought to form a part of the studies of the veterinary practitioner. It is a subject that is not only highly curious and interesting, but extremely useful. We find, that these animals, in their native fields, enjoy a state of health and vigour, which is interrupted only by those accidents to which a life of liberty and wildness may expose them. It is only when they are received under the protection of man, that they become subject to disease. It is therefore an interesting inquiry, to examine into their native habits; as, in our endeavours to preserve their health, we should, as nearly as is compatible with convenience and economy, imitate the habits that are found to prevail amongst these animals in a state of nature. It is the province of the naturalist to describe the external conformation of these animals, and the advantages, and defects dependant on it, that fit or disqualify them for the various purposes, for which they are destined under the service of man; it is his business to describe the methods of breeding these animals in a state of nature, and how far this may be improved for the purposes of domestication, and to detail the method of training and managing them. Many of these circumstances are treated of by some of the writers on the veterinary art, in a complete system of which they ought not properly to be omitted. We shall, however, not treat of them in this article, as, according to the plan of our work, they more properly fall to be considered under the article MAMMALIA, in which will be given the natural history of all quadrupeds.

15 Chemistry. Chemistry must form a necessary part of the studies of every man who engages in the practice of medicine, whether human or veterinary, as, without a knowledge of its principles, neither the functions of the animal economy, the intimate structure of its component parts, nor the action of many remedies, can be properly understood. In the article CHEMISTRY, we have prepared abundant matter for the reader to make himself acquainted with the elements of that admirable science.

16 Surgery. The practitioner, whether of human or veterinary medicine, who is a proficient in anatomy, wants but a little manual dexterity, and some practical experience, to make him a tolerable surgeon. The operations to be performed on brutes are few, and these are in general very clumsily executed. Humanity, however, as well as prudence, will readily point out to the farrier the necessity of learning the best methods of performing these operations with dexterity and despatch, so as to give the least pain to the unfortunate animals that are placed under his care. We shall describe the usual operations immediately after treating of the anatomy of the horse. Introduction.

It is of considerable consequence, that the person who undertakes the management of domestic animals, should make himself acquainted with those circumstances which experience has shewn to be most favourable to the preservation of their health, and the prevention of their diseases. This subject forms what may be called *veterinary hygeiology*; and will be considered at some length in the fourth part of this article. 17 Hygeiology

Before the practitioner can attempt to remove or alleviate the diseases to which domestic animals are subject, he must acquire a competent knowledge of the remedies employed for that purpose, their nature, uses, and doses, as adapted to the different animals, in various situations, and various diseases; with the methods of preparing and compounding them into the several forms that are usually employed; and with the best means of administering them. This comprehends what is called the *veterinary materia medica*, and will form the subject of our fifth part. 18 Materia medica

With this previous knowledge, the veterinary student is prepared to enter on the consideration of the diseases, which will be treated of in the sixth part of our article. He must be particularly attentive to the symptoms of each disease, as, on an accurate knowledge of these, will depend the means of distinguishing those complaints, which upon a superficial view bear considerable resemblance to each other, but which require a very different, and perhaps opposite mode of treatment. He must attend to the greater or less violence of these symptoms, to the nature of the part which they attack, and to the greater or less rapidity of their progress; as these circumstances must considerably influence the judgment he is to form of the danger, and probable termination, of the disease. He must, as far as possible, investigate the causes, that appear to have produced the disease in question, or which seem to aggravate or keep up the morbid symptoms; as on the removal or mitigation of these causes, must depend the only rational and scientific method of cure. Lastly, he must make himself acquainted with the treatment that experience has found most successful in the cure of each particular disease, as well as with that which has been found to be attended with little or no advantage. 19 Practice.

As the proper means of attaining the best information is of the greatest importance, we shall here give Mr Blaine's instructions on this point.

"The mode in which any art is attained, must be in a great measure directed by the future views of the learners. It appears to me that there are three distinct classes of persons, who are likely to study this branch of useful knowledge. The first are persons of enlarged minds, and extended fortunes. The second are surgeons, whose situation in country villages may render their services in this art highly useful, upon occasions when no farrier is at hand, or, in the end, in cases in which farriers of the common class are unable to judge. The third are farriers themselves, or persons intending to profess veterinary medicine.

"Gentlemen and amateurs, who wish to accumulate information on this curious and interesting subject, within the reach of the veterinary college, will find their account in attending a course of lectures there; it

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Introduction.

not, they ſhould apply themſelves to the ſtudy of the more general parts of the body, both of the human and animal; the latter, I hope, they may attain by the following ſheets. They may direct the collar-maker, huntſman, or tanner, to cut up their dead horſes in their preſence. They may ſtudy phyſiology in a pleaſant and intereſting manner, from the ingenious work on this ſubject by Mr Saumarez. The lighter parts of the veterinary art may be acquired with pleaſure, from the elegant publication of Mr Richard Lawrence of Birmingham, and a courſe of chemiſtry will amply reward them for their pains in acquiring it.

"A good ſurgeon has travelled three-fourths of the road towards making a good veterinarian, but he muſt diligently travel the remainder to arrive at excellence. He muſt by no means ſit down contented with the analogy between the human and brute; which, if he does, will lead him into very great error; for though this analogy is in moſt caſes very ſtriking, yet there are others in which the ſimilarity fails, and he is left to act upon other principles. Hence in thoſe diſeaſes that are conquered or mitigated by vomiting in the human; in the horſe he muſt purſue another mode of treatment. In acute diſeaſes removed by purging in the human, his attempts on the horſe would probably fail; as before the effects were produced, the animal might be paſt relief. It muſt be remembered that the operations of medicines are very different in the one, and the other. It is not ſufficient that a ſurgeon has an intimate acquaintance with the human frame; he muſt be equally converſant with the animal he treats, or he will treat in vain; particularly thoſe diſeaſes originating in a peculiarity of form from the human, as all the diſeaſes of the feet. He ſhould make himſelf particularly converſant with the ſpecific diſeaſes of the horſe, which bear no analogy to any thing in the human body; as farcy, glanders, ſtrangles, greaſe, &c. From the great ſtrength of the arterial ſyſtem, he muſt ever be aware how prone the diſeaſes of the horſe are to a rapid termination, and hence that his treatment muſt be deciſive and energetic; therefore, in all caſes, he muſt be very attentive to diagnoſtics. But what will much embarraſs a ſurgeon in practiſing the veterinary art, will be a want of knowledge of the general uſages, nomenclature, and idiom, if I may ſo expreſs it, among grooms and farriers; without an acquaintance with which, theſe people at once detect and deſpiſe the practitioner. It ſhould be the buſineſs therefore of the ſurgeon, with his other acquiſitions, to learn their manners, and to make himſelf acquainted with their terms. The third claſs of perſons, either farriers already practiſing, or perſons intending to practiſe, will eaſily gain that. When it is in their power, I would adviſe their taking the advantage of the veterinary college; but when they cannot, I would recommend the proſecution of their ſtudies in a regular manner. Begin by firſt reading ſome general deſcription of the human body, ſuch as Symond's Anatomy, or the anatomical part of the preſent work, carefully; let them pay attention to the functions and uſes of the parts, particularly where the ſame uſes are brought about by a variation in ſtructure; this enlarges the mind, and prepares it to receive the benefits of diſſection, which ſhould now be proceeded to. Any ſmall animal may be firſt diſſected, to enable the learner to uſe his inſtruments properly. He may then proceed to diſſect the horſe with ſome authorities by him, which will aſſiſt him at firſt to make out parts, but too ſcrupulous an attention to numerous deſcriptions will only bewilder. The neceſſary inſtructions for diſſection, and the preſervation of parts, may be gained, by a recourſe to Poole's Anatomical Inſtructor, which is profeſſedly written to inſtruct the pupil in theſe particulars. When he is well acquainted with the appearance of the animal in health, he ſhould take every opportunity of examining diſeaſed appearances, which are ſeldom wanting at the tan-yard or the kennel. He ſhould now make himſelf acquainted more intimately with phyſiology, for which purpoſe he may read Haller's works; there is at preſent a tranſlation of Cuvier's Treatiſe on Comparative Anatomy, which he may likewiſe avail himſelf of. When he has become acquainted with pathology, as at preſent received, he may peruſe the older authors on farriery; to this ſhould ſucceed a knowledge in chemiſtry, preceded by an acquaintance with the materia medica; the proper works for which he may ſee by a reference to that article, and nothing will now be wanting, but experience and practice to perfect him *."

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* *Blaine's Outlines*, vol. i.

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Means of promoting a knowledge of farriery.

Since the eſtabliſhment of a veterinary ſchool in Britain, little is wanting to promote the progreſs and improvement of the veterinary art, as far as relates to the diſeaſes of horſes. But the art, with reſpect to the medical treatment of other animals, is ſtill in the moſt deplorable ſtate of imperfection. Propoſals have been made for improving cattle medicine; and among theſe, we think the following of Mr John Lawrence, entitled to attention; though, probably the propoſer's liſt of works may be much improved and enlarged, by referring to the account of authors which will be immediately given.

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Mr Lawrence's propoſal.

Mr Lawrence's propoſal is ſimply, "that the affair of providing the country with regular-bred ſurgeons, for the practice of cattle medicine, be immediately undertaken by the agricultural ſocieties; at leaſt, that the experiment be made by ſome of the moſt conſiderable, each ſociety engaging a gentleman of that deſcription, at a ſufficient and reſpectable annual ſtipend. The contract may run in ſuch form, that ſhould the ſurgeon's annual emolument from practice come ſhort of the ſtipulated ſum, the deficiency ſhould annually be made up by his patrons the ſociety. No perſon to be engaged on any pretence, but who ſhall have received the uſual education of a ſurgeon, and have attended the hoſpitals the uſual length of time. A ſelection of *Veterinary text-books* to be made, and the books purchaſed for the uſe of the ſurgeon, but to remain the property of the ſociety. This may conſiſt of Gibſon's laſt edition, two vols. Bracken, Bartlett, Oſmer, Layard, with our late writers; and Lafoſſe and Bourgelat from the French, with whatever may have been publiſhed ſince their time, by authority of the French veterinary ſchools. All the members of the ſociety and their connections, as far as their influence may extend, to entruſt the care of their diſeaſed animals to the ſurgeon appointed, at a fair and liberal charge for his attendance and medicines. The ſurgeon to keep a regular hiſtory of all the caſes which ſhall come under his inſpection, including the preſumed cauſes and ſymptoms of the diſeaſe, with the probable methods of prevention, his mode of treatment, a particular detail of the medicines preſcribed, their operation, with every relative and uſeful remark which may occur.

History. A clear written copy of such veterinary transactions, to be delivered annually, and on a certain day, to the society, to remain at their disposal *."

* *Lawrence on Cattle.*

22 Importance of being acquainted with the history.

It is of considerable consequence for the practitioner to be informed of the rise and progress of the art which he professes, and to be acquainted with the principal authors that have written on the subject. We shall here, therefore, give a brief sketch of the history of Farriery, with a concise view of the writings that have appeared from the earliest authentic records to the present time (1806.) History.

Though we shall enumerate all the authors that have written professedly on this subject, who appear deserving of notice, we shall here characterize only the general treatises, reserving our remarks on such works as have appeared on individual diseases, &c. to that part of our treatise, in which we shall consider these subjects.

PART I. HISTORY.

23 Early history of the art very obscure.

THE early history of farriery, as of every other art and science, is involved in great obscurity. We shall not attempt to penetrate the cloud that hangs over the ancient state of the art, or to supply the want of facts, by conjectures, which, however rational, can lead to no certain or useful conclusions.

There seems no doubt that in the time of Hippocrates, and probably long before, the medical practitioner exercised his office in favour of the domestic animals, as well as of man; and Galen seems to have been well skilled in the knowledge and treatment of some of the diseases of animals.

24 Columella.

Perhaps the earliest authentic writings on the subject of the veterinary art, now extant, are to be found in the works of Columella, the celebrated Roman author on husbandry, who, in his work *De Re Rustica*, has given many sensible directions for the management of horses and cattle. Columella lived about the second century, under the reign of the Roman emperor Tiberius, or, as some say, of Claudius Cæsar.

25 Celsus.

It is understood that Celsus, the elegant imitator of Hippocrates, who lived some time before Columella, wrote much on the diseases of animals; but none of his writings on this subject have survived the general wreck of science and literature that accompanied the fall of the Roman empire.

26 Vegetius.

We have no certain accounts of any author who wrote expressly on this subject earlier than Vegetius, who flourished, as is supposed, sometime in the fourth century, and probably during the reign of the emperor Valentinian the third. The work of Vegetius, *De Arte Veterinaria*, is still considered as extremely valuable, as it has handed down to us the only certain account of the opinions and practice of the early practitioners in this art. The body of the work appears to have been compiled from the most celebrated Greek writers on the subject. It is divided into four books; the prefaces or introductory chapters to which are written in very elegant language.

An edition of Vegetius was published at Basil, in 1574; and the work has been translated into several modern languages. Such of our readers as wish for a particular account of the contents of Vegetius's treatise, will find a copious analysis of it, in the third volume of M. Vitet's *Medicine Veterinaire*.

27 Ruelli's collection.

A collection of fragments of ancient writers on the veterinary art, was made by Ruellius, physician to Francis I. king of France. It was first published in Latin, in the year 1530; and afterwards, in 1637, the original Greek was published. The writers who contributed to this collection were chiefly Absyrtus, Eumelus, Hierocles, Petagonius, and Theomestus. Some part of this collection is tolerably good; but, on the whole, it appears to be a strange jumble of good, bad, and indifferent, collected without judgment, and arranged without taste.

28 Xenophon.

It is said that Xenophon, who lived three or four hundred years before the Christian era, wrote a small treatise in twelve chapters, on the training, management, and external figure of horses; but, as he says little or nothing with respect to their diseases, he cannot properly be ranked among the writers on veterinary medicine.

29 Dark ages.

A blank of more than a thousand years now occurs in the history of farriery. During this long period of darkness, ignorance, and barbarity, the veterinary art, like most others, rather went back than advanced. During some part of this gloom, however, the art of shoeing horses with iron appears to have been invented; an art which seems to have contributed not a little to throw the management of this noble animal into the hands of a set of errant blockheads, who were now first called farriers. We cannot here enter on a discussion of the medical pretensions of these guardians of the health of horses. They have been amply commented on, by some of the best writers on the subject of farriery, as Gibson, Bracken, Lafosse, and particularly Mr John Lawrence, to whose useful and humane treatise on horses we refer our readers for some very spirited remarks on the subject.

30 Ruini.

The first modern writer on farriery, whom we can mention, is Carlo Ruini, an Italian, who, in 1618, published at Venice his Anatomia del Cavallo. This work, of which very few copies are now to be found, is embellished with many copperplates, which, for the time when they were engraved, are very elegant. It is said that many succeeding writers on the anatomy of the horse have been indebted to them for most of their figures.

31 Progress of farriery in France.

We now come to a period at which the veterinary art began to assume something of a scientific form. Many writers of eminence began to appear both in France and England, countries which have been the most distinguished for their attention to the management and diseases of domestic animals. As the French writers were the first, who did any thing considerable towards the improvement of farriery, we shall trace the progress of the art in that country, before we examine the improvements it has received in England.

34 Solleysel.

In 1698 Solleysel published his grand work, "*Le parfait*

History. *parfait Marechal*," *the complete Horſeman*, a work, which gained its author a high reputation, and was long the only guide, as well in farriery as in the manege.

M. Solleyſel was principal riding-maſter in France, and this ſituation led him to pay much attention to the diſeaſes of horſes; and being a man of conſiderable abilities, and enlightened underſtanding, he ſaw the errors that prevailed in his time; and his genius and experience led him to expoſe and to correct them. His practical obſervations and remarks, which it would be out of place to particularize in this early part of our article, in general merit conſiderable attention. His obſervations on the external figure of the horſe, and of his blemiſhes and defects, are alſo very valuable. It is much to be regretted that this ingenious author had not ſtudied the anatomy of the horſe, as he would then have avoided many errors and much falſe reaſoning, into which his ignorance of anatomy betrayed him. Solleyſel's work paſſed through many editions, and was tranſlated into moſt of the modern languages. A verſion of it into Engliſh was executed by Sir William Hope, one of his pupils, early in the 18th century.

33 Appearance of the murrain in Europe.

The dreadful havock committed by the murrains or epidemic diſeaſes among horned cattle, that ravaged Europe during the firſt half of the 18th century, attracted the attention of medical men, and thus led the way to a greater improvement in the veterinary art, than it had ever before experienced. Theſe epidemics were firſt deſcribed by two Italian phyſicians, Ramazzini, in a treatiſe *De Contagione Epidemica;* and Lanciſi, phyſician to the pope, in a treatiſe *De Bovina Peſte*. But the moſt celebrated works on the prevailing epidemic ſeem to have been written by the faculty in France. Among the firſt appeared a memoir by M. Hermant, phyſician to the king.

34 Sauvages.

In 1746 was publiſhed a memoir *Sur la Maladie Epidemique des Boeufs du Vivarais*, by the celebrated noſologiſt Sauvages.

35 Eſtabliſhment of veterinary ſchools.

About the middle of this century, the firſt ſteps were taken towards the eſtabliſhment of ſchools for the public inſtruction of practitioners in farriery. One of the moſt celebrated of theſe was the veterinary college of Lyons.

36 Bourgelat.

Over this inſtitution preſided the famous Bourgelat, a name that will be ever reſpectable in the hiſtory of farriery. Beſides his office of profeſſor at Lyons, he was inſpector general of the veterinary ſchools in France; commiſſary general to the royal ſtables; honorary member of the Royal Academy of Paris, and member of the Royal Academy of Berlin. M. Bourgelat was a voluminous writer, and moſt of his works are ſtill in much repute. In 1752, he publiſhed *Elemens d'Hippiatrique*, "Elements of Farriery," in 3 vols. The firſt volume is divided into eight chapters, comprehending the knowledge of the horſe, as far as regards his external form. The firſt chapter treats of the denomination and diviſion of the parts that compoſe the body of this animal; the ſecond treats of the beauties and defects of the fore part of the horſe, or what the French writers call *l'Avant Main*; the third treats of the beauties and defects of the ſeveral parts of the body; the fourth, of the beauties and defects of the hind part of the horſe, or *l'Arriere Main;* the fifth, of the different marks of horſes; the ſixth, of the means of aſcertaining the age of horſes; the ſeventh, of the geometrical proportions of the horſe; and the eighth, of ſhoeing. History.

The ſecond volume deſcribes the anatomy of the horſe, as far as relates to the bones, the integuments, the muſcles, and blood veſſels; and the third volume concludes the anatomy with a deſcription of the parts that compoſe the head and cheſt.

In 1765, M. Bourgelat's materia medica, for the uſe of the veterinary pupils, came out. Soon after was publiſhed his Elementary Treatiſe on the Anatomy of the Horſe, which is the moſt complete work of the kind that has ever yet appeared. In 1766 he publiſhed his Elementary Botanical Demonſtrations, for the uſe of the pupils of the veterinary college. He likewiſe gave to the world a treatiſe on bandages applicable to the horſe.

M. Bourgelat alſo furniſhed many of the beſt articles on farriery for the French ENCYCLOPEDIE.

37 Buffon and Daubenton.

About this time appeared a number of works on the manege, and on natural hiſtory, particularly a work by M. de la Guerincere, entitled *Ecole de Cavalerie*, and the celebrated natural hiſtory by M. de Buffon and Daubenton; but as theſe works have little connection with the diſeaſes of animals, which they mention only incidentally, we ſhall not here particularize their contents.

38 Lafoſſe the Elder.

Contemporary with Bourgelat, and equal to him in celebrity, flouriſhed Lafoſſe the Elder, a member of Royal Academy of Sciences at Paris, and farrier to the king of France. He made many diſcoveries, and introduced ſeveral valuable improvements in the art of farriery, particularly an improved method of ſhoeing, and a treatiſe on the glanders. Theſe were at firſt communicated in the form of memoirs to the French academy, and publiſhed in their annals. They were afterwards collected in 1754 into one volume, under the title of *Obſervations et Decouvertes Faites ſur des Chevaux;* "Obſervations and Diſcoveries on Horſes." We ſhall have occaſion, in future parts of our article, to conſider the merits of theſe memoirs, which were well received, and have contributed much to the advancement of farriery.

The elder Lafoſſe alſo wrote ſome of the articles on farriery in the ENCYCLOPEDIE.

39 Lafoſſe the Younger

He was ſoon followed by his ſon Lafoſſe the Younger, who occupied the ſame poſt as his father, and has acquired much reputation, by following his ſteps, and extending his improvements. He publiſhed, in 1766, his *Guide de Marechal*; or "Farrier's Guide;" a work well known in this country, though it has never, we believe, appeared in an Engliſh dreſs. It is divided into five parts, treating, 1ſt, Of the means of aſcertaining the age of horſes, and a ſuccinct enumeration of the ſeveral parts; 2d, Of the blunders and tricks of farriers; 3d, Of the internal diſeaſes of the horſe; 4th, Of the external diſeaſes, and the moſt important operations; and, 5th, Of ſhoeing. This work is characterized by M. Vitet, as one of the moſt accurate, ſimpleſt, and moſt *preciſe*, that had ever appeared. The anatomical part of the work is ſhort, but comprehenſive, and is illuſtrated by ſome tolerably good plates. It appears to have been a ſort of text-book to a courſe of lectures on farriery, which were afterwards, in 1772, publiſhed in a ſuperb form, with 65 coloured plates, under the title of *Cours de Hippiatrique;* or "Courſe

History. of Farriery." This work is extremely ſcarce in Britain, where, according to Mr Blaine, there are only three copies of it; one of which belongs to the Medical Society of Woolwich; another is in the hands of a Mr Mathaiſa, ci-devant pupil of the Veterinary College; and he believes Mr Morecroft has a third.

But the principal work of the younger Lafoſſe is his *Dictionaire d' Hippiatrique*, in four volumes, which is little known in this country, and which we have not ſeen. Mr Blaine calls it "the beſt practical ſyſtem of farriery that had ever appeared."

In 1803 was publiſhed an abridgement of M. Lafoſſe's Guide, of which an Engliſh tranſlation has lately appeared under the title of The Veterinarian's Pocket Manual. It is a uſeful little book, but it is a pity that the author or tranſlator had not obſerved a more methodical arrangement.

Though, for the ſake of uniformity, we have mentioned the younger Lafoſſe immediately after his father; there were many works publiſhed in France between the Memoirs and the Guide.

40 Garſault. In 1755, M. Garſault publiſhed his *Nouveau parfait Marechal*, an improvement on the *Parfait Marechal* of Solleyſel. It is divided into ſeven treatiſes; on the Conformation of the Horſe; on Haras, or on the Method of Breeding; on Stables; on the Diſeaſes of Horſes; on Operations; on Shoeing; and on Horſe Medicines. This work is not without defects, but, for the moſt part, it is very good, and by no means deſerves the brief character given of it by Mr Blaine in his Hiſtory of the Veterinary Art, that it "does not ſeem to merit any diſtinction in this place."

41 Ronden. The articles on farriery in the Encyclopedie that had been written by Bourgelat and Genſon, called forth a work from M. Ronden, ſenior, farrier to the larger ſtables of the king; who, in 1759, publiſhed *Obſervations ſur les Articles de l' Encyclopedie concernant la Marechallerie*. They appear to be ingenious, and contain much practical information.

42 La maiſon ruſtique. In 1763 there appeared at Paris a work on agriculture in two volumes 4to, entitled, *La Nouvelle Maiſon Ruſtique*, which contains much uſeful matter reſpecting the breeding, management, and diſeaſes of domeſtic animals, as well fowls as quadrupeds.

The contagious epidemics among horned cattle ſtill appeared occaſionally in France and other parts of Europe; and many eſſays were written on them by various phyſicians, particularly by M. Bovand of Beſançon, in 1766; by M. Leclerc and M. Barbaret, of Paris, in the ſame year.

In 1768 Daubenton, the celebrated naturaliſt, already mentioned, publiſhed a memoir on the mechaniſm of rumination in ſheep; and in 1769, appeared a ſmall volume entitled *La Medicine des Bêtes a Laine;* "the Medical Treatment of Sheep."

43 Vitet. Between 1776 and 1782, M. Vitet, a phyſician at Lyons, publiſhed his *Medecine Veterinaire*, in 3 vols 8vo. of which the firſt contains a pretty full account of the anatomy of the horſe and ox, with ſome judicious remarks on the beauties and defects of both, and on ſome of the more important operations to which they are expoſed; the ſecond treats of the diſeaſes of horſes, ſheep, and cattle; and the third gives an account of the remedies employed in veterinary medicine; and ends with a copious analyſis of moſt of the continental writings, and a few Engliſh, that had appeared on the ſubject, from Vegetius to 1770. History.

M. Vitet's work is, for the moſt part, a compilation from the beſt writers who have gone before him; but as he had read much, and appears to have ſelected with judgment, his book is one of thoſe which may be conſulted with advantage. We know that it bears a high character in France, and is often quoted with reſpect. We are therefore diſpoſed to rate it at a higher value than a late writer has done; and are inclined to ſuſpect that ſome of thoſe who affect to think lightly of it are indebted to it for much more than the "names of many of thoſe who have written on this ſubject."

44 Rozier Much about this time, but in what preciſe year we cannot ſay, the abbé Rozier, well known as the editor of the early volumes of the *Journal de Phyſique*, publiſhed his *Cours d' Agriculture et de Medicine Veterinaire;* a work of much reputation in France, but, we believe little known on this ſide the water.

45 Paulet Another work appeared about this time on the epidemics among cattle, entitled *Recherches Hiſtoriques et Phyſiques ſur les Maladies Epizootiques;* "Hiſtorical and Philoſophical Reſearches reſpecting Epizootic Diſeaſes," by M. Paulet. It contains an abridgement of almoſt all that had been written on the ſubject, and is particularly valuable for the account of the morbid appearances that were diſcovered on diſſection.

We ſhall finiſh our account of French writers in the words of Mr Blaine,

46 Huzard and Chabert. "After the death of Bourgelat and Lafoſſe, we hear of no character of any great eminence for ſome years; but it appears, that ſince the revolution, the ſubject has again been more diligently ſtudied, and the names of Chabert and Huzard ſtand forward. Soon after, or about the time above alluded to, there appeared a conſiderable work, called, The Rational Dictionary of Medicine, Surgery, and Farriery, in ſix volumes; and very ſoon after, a Veterinary Dictionary, by Buchon; but it has no merit ſuperior to that of Lafoſſe. In 1787, M. Chabert publiſhed a Treatiſe on the Mange of Horſes; ſince which he has likewiſe publiſhed upon the peripneumonia of black cattle. There has alſo appeared an Eſſay on the Greaſe of Horſes, which gained the prize medal of the ſociety for the promoting the health of animals; to which is joined a report on thick wind and on broken wind; but we are not aware who is the author. In 1788, there came out a treatiſe on the *haras*, with the method of ſhoeing, cutting, and all the leſſer operations, tranſlated from the Spaniſh of Hartmann, by Huzard. Likewiſe "Inſtructions and Obſervations on Domeſtic Animals, with remarks on the breeding, rearing, buying and ſelling; with an analyſis of previous authors, by Chabert, Handrin, and Huzard. The above authors have alſo publiſhed, conjointly, a Veterinary Almanack, containing the hiſtory and progreſs of animal medicine, ſince the eſtabliſhment of the veterinary ſchools. In 1791, M. Lamagieu Lapole, veterinary ſurgeon, publiſhed obſervations on the health of the animals of St Domingo, dedicated to the veterinary college at Alfort. In 1797, M. Chabert and M. Huzard publiſhed, by order of government, a treatiſe on aſcertaining the exiſtence of the glanders, the means of preventing it, and deſtroying the infection." *

* *Blaine's Outlines*, vol. i.

47 Progreſs of farriery on the continent. Before we detail what has been done in Britain for the advancement of the art, we muſt take a curſory view

History. view of the principal writings that appeared during the 18th century in the rest of Europe.

48 Goelicke. In 1730, Goelicke, a German, published a treatise in 4to, *De Lue Contagiosa Bovium;* "On the Contagious Disease of Cattle;" in which the symptoms of the murrain that raged in Flanders about that time are well described; and there are added the appearances on dissection.

49 Saunier. In 1734, appeared at the Hague a work entitled *La parfaite Connoissance des Chevaux;* "The Complete Knowledge of Horses;" by John Saunier, and Gaspard his son. The latter boasts of this work, that it was drawn up from the lectures of his father, an experienced man; and that it contains the result of numerous experiments on subjects of every description, and diseases of every species; that it is the labour of the life of two men, the offspring of their continual application and study. After all their boasting, however, the work of Mynheers Saunier is little worth.

In 1745 and 1746, appeared two other treatises on

50 Linnæus. the epidemic of cattle by Mauchard and Ens.

In 1749, the illustrious and indefatigable Linné published at Upsal his *Pan Suecicus*, in which there is little that relates to our subject, if we except a table of such plants as are eaten or refused by the domestic animals, which is curious and useful.

51 Hastfer. Some time before 1756, Frederic Hastfer, a Swede, published Instructions for Improving the Breed of Sheep, which was in much repute, and was translated into French.

52 Reynier. In 1762, M. Reynier of Lausanne published a treatise on a contagious inflammatory disorder that raged among horses and cattle, and which the Geneveſe called *la louvet*. This will be considered hereafter.

In the same year there appeared at Vienna a work on the epidemic of cattle by Dr Pleneiz; and in 1765 Mich. Sagard of the same city published a work on a contagious distemper that the year before attacked the cattle in the circle of Iglaw in Moravia; and was attended with an appearance of aphthous crusts in the

53 Hartmann. mouth.

Of late veterinary medicine has been much cultivated in Spain, where the works of Hartmann are held in much esteem. In that country, it is said, a work on farriery in nine volumes has been lately published; but

54 Camper. of this we know nothing.

We must not close our account of continental writers without mentioning the name of the illustrious Camper, whose works were lately collected and published at Paris. Besides a long description of the structure of the oran-outang, and some lesser essays on comparative anatomy, these volumes contain an elaborate history of the epizootic disease that raged among the cattle on the continent in the middle of last century, in the form of lectures. We shall speak of this work hereafter.

We have thus brought the history of this art on the continent in a concise manner, down to the present time; and from it may be learned what improvements have originated there, and at what periods. It would appear, that when the science began to command attention, from the exertions of Francis the first, and Vegetius became studied, had it progressively improved in the degree it might be supposed to be placed by a conversance with this author, it would ere this have been more approximating to perfection: but instead of proceeding on the rational system of Vegetius, it dwindled again into ignorance of barbarity; and the recipes of manege-masters, and the operations of blacksmiths, were the only ostensible marks of its assistance. From this state the practitioner became in some degree roused by the improved system of Solleysel; but he could only combat present errors, he could not point the way to future improvement, for he was ignorant of the groundwork whereon to build it, i. e. the anatomy of the animal. This defect was only in a small degree supplied by the labours of Ruini, and in some measure farther assisted by the demonstrations of Bourgelat. Many of the remaining errors were combated by Lafosse with great advantage; and his experiments and discoveries on glanders, the rationality and improvements of his mode of shoeing, entitle him to great merit. Yet, though by these exertions, and by the establishment of veterinary seminaries, the art assumed a more regular and scientific form, its attainments were by no means adequate to its opportunities; which was almost wholly owing to an obstinate adherence to the humoral pathology, by which the treatment of internal and acute diseases continued inert and unsuccessful. Their prescriptions were filled with decoctions of simples, and they were utterly unacquainted with the medicinal virtues of the more active remedies in use among us. Under an opinion that the blood and humours were the constant seat of disease, they were continually washing them sweet with correctors; entirely ignorant or unmindful of the derangements of the solids, and of the connections between living blood and living vessels. Nor did this influence only their treatment of internal and acute diseases; but even of local and chronic affections: hence their mode of treating farcy, grease, and other complaints of a similar nature, were equally inert, and all evinced an erroneous pathology. Upon a careful and unprejudiced review of the state of farriery among ourselves, and on the continent of Europe, we are not inclined to think it had any advantages of moment at the beginning of the war in their favour; though it must be allowed, we are indebted to them for many improvements, and for the first hints towards the establishment of a regular school of the art among us. Since the war, our means of communication are so few, that we are not aware of what is doing among our neighbours. But though farriery, as a branch of veterinary medicine here, has kept nearly equal pace with its continental improvements, I do not think (says Mr Blaine,) the treatment of other animals, particularly of *oxen*, *cows*, and *sheep*, has been equally attended to; and, in this particular, I am disposed to think we are behind hand with them. Their severe visitations of the epizootic distemper have made them more attentive to this branch of the art." *

* *Blaine's Outlines.*

55 Progress of farriery in Britain. In taking a view of the history of farriery, or veterinary medicine in general, in our own country, it will be seen, that we were much longer in improving the art, and reducing it under a rational and scientific form, than our neighbours on the continent. Our earliest writers on the diseases of horses and cattle, were deplorably ignorant, not only of all principles of general medicine and sound practice, but even frequently of the common appearances of the diseases, which they professed to cure.

56 Blundeville. Our first writers on the treatment of the diseases of horses,

History. horſes, were, as in France, chiefly riding-maſters; and of theſe, the firſt that ſeems worthy of notice is Blundeville, who lived, as we have already obſerved, in the reign of Queen Elizabeth. His work appears to have been principally compiled from the writings of Vegetius, and other ancient writers; and it contains little that can entitle it to any diſtinction, as a work of utility. It may, however, be peruſed as a literary curioſity.

57 The names of many writers, after Blundeville, are mentioned by thoſe who have written on the hiſtory of farriery; but they are all ſtill inferior to Blundeville, except perhaps Burdon, on whoſe work, notes were written by Dr Bracken.

58 Markham. About the end of the 17th century, lived Gervaſe Markham, a name in high repute amongſt grooms and farriers, even to this day. He publiſhed a work on Farriery, which he called his *Maiſter Peece*, and which is one of the ſtrangeſt compounds of nonſenſe and abſurdity that has ever appeared on the ſubject.

In the opinion of Mr Lawrence, Markham was nothing more than a mere vulgar and illiterate compiler; and his works, ſome few things excepted, are ſtuffed with all the execrable traſh that had ever been invented by any writer, or practiſed by any farrier, ancient or modern, on the ſubject of horſes. It is neceſſary, however, that we do juſtice to the character of Gervaſe Markham; he certainly poſſeſſed a ſpecies of merit which has not deſcended to all his ſucceſſors, the copyiſts and plagiariſts; he very honeſtly gives the names of thoſe authors from whom he derives his knowledge.

59 Baret. Some years after Markham, Michael Baret publiſhed a book, which he called the *Vineyarde of Horſemanſhip*. This we have never ſeen, but it appears to be of

60 Duke of Newcaſtle. ſome repute. The next writer on this ſubject, is the duke of Newcaſtle, who gave to the world a moſt ſuperb work on an improved method of breeding and managing horſes. This work bears a very high character, not only from the name of the illuſtrious perſon by whom it was compoſed, but from its own intrinſic merit. The duke is quoted with reſpect by moſt ſucceeding writers; and his work has been tranſlated into French, German, Dutch, and Italian. It chiefly relates to horſemanſhip, but as it contains ſome excellent obſervations and maxims on the breeding of horſes, it naturally comes to be conſidered here.

61 Snape. In the latter end of the 17th century, Andrew Snape, who was farrier to Charles II. publiſhed a large work on the anatomy of the horſe, illuſtrated with many copperplates. Theſe plates appear not to have been taken from his own diſſection, but are moſtly copied from preceding authors, eſpecially from Ruini. Mr Blaine, however, is miſtaken in aſſerting that ſome of them are copied from Saunier, as Snape's work was publiſhed in 1683, whereas Saunier's did not appear, (according to Vitet) before 1734. It is ſaid that Snape had projected a larger work on the diſeaſes of horſes, but this he did not live to execute.

62 Gibſon. Early in the 18th century, farriery experienced a conſiderable improvement from the writings of Mr William Gibſon. This gentleman had been a ſurgeon in the army, but relinquiſhed that ſituation for the practice of farriery, which he probably expected to find more profitable. Mr Blaine places this writer in the middle of the laſt century; but his firſt work entitled "The Farrier's New Guide," was certainly publiſhed previous to the year 1721, as we have ſeen a ſecond edition of it advertiſed in that year. This was the moſt ſcientific work on the diſeaſes of horſes, that had then appeared in the Engliſh, or perhaps any language. The detail of ſymptoms is in general juſt, accurate, and the plan of treatment adviſed is for the moſt part very judicious. The anatomical part of Mr Gibſon's work is not ſo valuable, being frequently incorrect, and evidently not the reſult of his own obſervation. The Farriers Guide was ſoon followed by The Farriers Diſpenſatory, containing an account of the remedies employed in farriery, and the means of preparing and exhibiting them. This work is far inferior to the former, and is now of little uſe. In 1721, Mr Gibſon publiſhed a ſmall work on The True Method of Dieting Horſes, which contains ſome judicious remarks on the means of preſerving the health of this uſeful animal; as alſo on the breeding of horſes: with ſome obſervations on their external form, their ſagacity, and habits. This book muſt have been very valuable at the time of its publication, but is now in a great meaſure ſuperſeded by Clark and other later writers.

History. About 1750, Mr Gibſon publiſhed a larger work, On the Diſeaſes of Horſes, in which he has brought together the ſubſtance of his former works on farriery, with ſome improvements. There is, we believe, a later edition of it in two vols. Mr Gibſon muſt be conſidered as one of thoſe to whom farriery is moſt indebted for its improvements. He was almoſt the firſt, at leaſt in this country, to reſcue the art from the hands of the illiterate empirics, to point out their blunders, and correct their errors. Mr John Lawrence, who has given a very full account of Mr Gibſon in the firſt volume of his treatiſe on horſes, perhaps goes too far in ranking him on an equality with ſome of our preſent writers; while theſe again have erred as much on the other ſide, in detracting from the merits of a man to whom they are all more or leſs indebted for much of their moſt valuable matter.

63 Bracken. Gibſon was followed in his plan for the improvement of farriery by Dr Bracken, a phyſician at Lancaſter, and a pupil of Boerhaave, who publiſhed a work called Farriery Improved. "Bracken (ſays Mr Blaine) was phyſician of great abilities and extenſive knowledge in his profeſſion; a man of conſiderable erudition, a ſportſman, and a wit of a peculiar caſt. His works have by ſome been as much admired and read for the peculiar ſtyle in which they are written, and that peculiar freedom and non-obſervance of rule or form, as for the real information they contain.

Though there is great ingenuity in his writings, and though in many reſpects he improved upon Gibſon, yet as a practical work it was much inferior; nor was his information given in a way that could benefit the generality of his readers: independent of his ſtyle being too peculiar, and his reaſoning too abſtruſe for farriers, his manner of purſuing his ſubject was ſo deſultory, that few readers had patience to follow him. Nevertheleſs his works, which were ſeveral, and paſſed through many editions, have raiſed him a fame that can only die with the ſcience."

Theſe two writers may juſtly be conſidered as the fathers of Engliſh farriery; they eſtabliſhed their ſyſtem

History. on the only ſure foundation, the analogy which prevailed between the ſtructure, economy, and diſeaſes of man and of brutes. The beſt practice in this country has been derived from their inſtructions; and their works formed an example, by following which, later writers have greatly improved the art.

64 Bartlet. The next writer of reputation was Mr John Bartlet, alſo a medical man, who about the middle of the laſt century publiſhed his, Gentleman's Farriery, and afterwards his Veterinary Pharmacopeia. Bartlet had formed himſelf on the model of Gibſon and Bracken, the beſt parts of whoſe writings he has given in his farriery, condenſed into a more compendious view. He alſo enriched his work by the moſt material improvements of Lafoſſe, whoſe memoirs on ſhoeing and on glanders, he tranſlated into Engliſh.

65 Oſmer. Soon after Bartlet, appeared Mr William Oſmer, a ſurgeon and a ſportſman, who practiſed farriery in Oxford ſtreet, London. He was the principal means of introducing into this country the French mode of ſhoeing, which, in his treatiſe on the lameneſs of horſes, he adapted to the Engliſh manners, ſo as to render of ſervice, what had been before nearly uſeleſs and impracticable. Mr Oſmer's mode of ſhoeing will be mentioned hereafter. From the above works many compilations were ſoon made; theſe were generally below mediocrity, amongſt which, one called the Farrier's Dictionary, though a very wretched compoſition, met with a very rapid ſale. We muſt except from theſe a ſmall treatiſe by a Mr Blount, ſurgeon, which is above the common claſs, and worthy of notice, from an ingenious contrivance, illuſtrated by a plate, for ſecuring a fractured limb.

66 Brockleſby. In the year 1746, Dr Richard Brockleſby, a friend of Dr Mead, publiſhed a pamphlet on the diſorder that juſt before raged among horned cattle. It ſhould ſeem that this book is very little known beyond the circle of medical men, as we have not ſeen it referred to by any writer on the diſeaſes of cattle.

67 Layard. Brockleſby was followed on the ſame ſubject by Dr Layard. We ſhall ſpeak particularly of theſe two authors, when we come to treat of the murrains.

68 Clark. About 30 years ago, Mr James Clark, farrier to his majeſty for Scotland, publiſhed an ingenious Treatiſe on Shoeing, and on the Diſeaſes of the Feet of Horſes. This was ſoon followed by his Treatiſe on the Prevention of Diſeaſes Incidental to Horſes. By this latter work Mr Clark has acquired much reputation, as a ſcientific farrier, and a ſenſible writer. It contains ſome judicious obſervations on ſtables, diet, and exerciſe, on blood-letting, rowels, and ſetons; with remarks on the uſes and adminiſtration of the more common remedies. Mr Clark's book is in general well calculated to produce a more judicious and humane method of treating horſes, than uſually prevails. But it would have been more uſeful, had the author omitted much of the theoretic diſcuſſion, into which he has entered on ſome parts of the animal economy, on the nature of diſeaſe, and on the action of remedies. Mr Clark is a good practical writer, but his theory is often very lame, or very obſcure. He had an eaſy opportunity of attending the medical lectures, which were taught at Edinburgh in his youth, when the humoral pathology and the theory of Boerhaave were in full vogue. Mr Clark has here and there interſperſed among his practical remarks much of this old leaven. But as he probably had not received ſuch a previous liberal education as might fit him for the judicious application of what he heard, he is often deficient in that theoretical knowledge which he takes ſo much pains to diſplay. History.

69 Lord Pembroke. Some years before the publication of Mr Clark's laſt mentioned treatiſe, viz. in 1778, Lord Pembroke favoured the public with his excellent diſſertation on the management of dragoon horſes, with ſome remarks on ſhoeing. This work is entitled, Military Equitation, or a Method of Breaking Horſes. Though the obſervations, contained in his lordſhip's work, were intended for the uſe of the Britiſh cavalry, they are for the moſt part applicable to horſes in general, and well merit the attention of farriers and others concerned in the management of horſes. We do not well underſtand what Mr Blaine means by aſſerting that Lord Pembroke derived the principle of his medical hints from Mr Clark. If he means that his lordſhip borrowed any thing from Mr Clark's treatiſe on preventing the diſeaſes of horſes, he is certainly miſtaken, as the firſt edition of this treatiſe, which we believe has not been reprinted, appeared in 1788, and in it Mr Clark often quotes Lord Pembroke's work (c).

70 Stubbs. Much about this time Mr Stubbs publiſhed his elegant plates of the anatomy of the horſe, of which work, as the production of an artiſt, we cannot ſpeak too highly. Mr Stubbs is a very eminent painter of animals, and to much profeſſional excellence in this capacity, he has added a conſiderable ſhare of anatomical knowledge. Hence his figures are in general extremely correct, and will be found very uſeful to thoſe who have not the opportunity of availing themſelves of real ſubjects.

71 Taplin. One of the lateſt writers on the ſubject of farriery is Mr Taplin, who for ſome time enjoyed a conſiderable reputation, both as a practitioner and as a writer. But this reputation has been materially ſullied, ſince it was diſcovered, that Mr Taplin is not only ignorant of the anatomy of the horſe, but has liberally copied from thoſe very writers whom he takes every opportunity to vilify and abuſe. As from his flagrant plagiariſm and arrogance, Mr Taplin has well deſerved *the dreſſing* which he has recently received from ſeveral late writers, we ſhall turn him over into the hands of one of his rivals, who does not ſeem diſpoſed to ſhow him any mercy.

"This gentleman likewiſe began his career as a ſurgeon, but turned aſide to the then more profitable track of farriery. Mr Taplin ſet out by decrying all that had gone before him, all that were in practice with him, and in fact every thing that has been done by any one ſince. Yet Mr Taplin's works are ſaid to be compilations from thoſe very authors whom he abuſes; and, in ſome inſtances, after abuſing egregiouſly, he copies literally.

(c) We find that Lord Pembroke's work was firſt publiſhed about 1761. The edition mentioned in the text is, we believe, the ſecond.

Hiſtory. ally. Unfortunately for this gentleman, from ſome late improvements, the people of this country have learned to diſtinguiſh in this art, as well as in others, between ſcientific inveſtigation and verboſe quackery. Had Mr Taplin ſet out by ſtudying the ſtructure and economy of the animal, he might, and undoubtedly would, have proved an ornament to the profeſſion; but when he permits his works to go through ſo many editions, in the face of criticiſms from all quarters, with a chapter on diſeaſes of a part that has no exiſtence in the horſe, i. e. *the gall bladder*, we muſt be aware that he is entirely ignorant of that, upon which every pretenſion to profeſſional merit muſt be grounded. Mr Taplin indulges himſelf in the moſt unreſtrained freedoms in ſpeaking of thoſe who have gone before him, yet copies verbatim from them; he cannot wonder, therefore, that he has been treated with conſiderable ſeverity by later writers; nor can he be ſurpriſed that a practice ſo begun and ſo continued has ended as his has *."

* *Blaine's Outlines*, vol. i. p. 63.

Mr Taplin is the author of ſeveral works on farriery. His firſt publication was, we believe, The Stable Directory, which had a great ſale. He next publiſhed a larger work, in two volumes; and lately he has ſent out a ſmall pamphlet called *Multum in parvo*, which is ſuppoſed to be merely intended to advance the ſale of his prepared horſe medicines.

72 London veterinary college.

The end of the 18th century will ever be memorable in the hiſtory of farriery, for the eſtabliſhment of an inſtitution for the public teaching of the veterinary art in England, in imitation of thoſe ſchools in France of which we have already ſpoken.

73 St Bel.

The veterinary college owes its origin to M. St Bel, a French gentleman, born at Lyons, and who was firſt junior aſſiſtant to the profeſſor of the Royal Veterinary College there, and afterwards profeſſor of anatomy at the veterinary college of Montpelier. This gentleman came to Britain in 1788, and publiſhed propoſals for eſtabliſhing a veterinary ſchool in this kingdom. Theſe propoſals did not, at that time, meet with encouragement; but two years after, when M. St Bel, driven from his native country by the horrors of the revolution, again viſited England, his propoſals were taken again into conſideration by an agricultural ſociety at Ockham in Hampſhire. It had been the intention of this ſociety, to ſend two young men to France, to ſtudy the veterinary art ſcientifically; but on hearing the propoſals of M. St Bel, they abandoned this idea, and appointed a committee to conſult with him on the beſt means of forming a ſchool for teaching the art in this kingdom. To this ſchool they gave the name of *the Veterinary College of London;* and M. St Bel was appointed the firſt profeſſor.

The following gentlemen were appointed to the management of this inſtitution.

His Grace the Duke of Northumberland, Preſident.

Vice Preſid.:
- Earl Groſvenor,
- Earl Morton,
- Earl of Oxford,
- Lord Rivers,
- Sir George Baker, Bart.
- Sir T. C. Bunbury, Bart. M. P.
- Sir W. Fordyce,
- John Hunter, Eſq.

Directors:
- Sir John Ingleby, Bart. M. P.
- Sir H. P. St John Mildmay, Bart.
- G. M. Aſcough, Eſq.
- Mr John Baynes,
- Mr J. Burgeſs,
- Rev. T. Burgeſs,
- Rev. J. Cook.
- Dr Adair Crauford,
- John Gretton, Eſq.
- Dr Hamilton,
- Mr Rennet,
- Dr D. Mapleton,
- Granville Penn, Eſq.
- Mr William Stone,
- Richard Tophane, Eſq.
- Dr Williams,
- J. Wollaſton, Eſq.

Treaſurers:
- Meſſrs Ranſom,
- Moreland,
- and Hammerſly,

A houſe was taken, for the purpoſe of the inſtitution, and pupils were admitted to board in the houſe.

The ſucceſs of this inſtitution, at firſt, by no means anſwered the expectations of the founders. It appears that M. St Bel was prevented, by the embarraſſed ſtate of his circumſtances, from executing the office of profeſſor, with that ardour and activity, which was neceſſary to the reputation of the infant ſchool; and indeed it ſeems, from the ſpecimen he has left us of his profeſſional abilities, that theſe were not adequate to the office he had undertaken. He poſſeſſed conſiderable induſtry, and it is probable that, had he lived, he would have ſucceeded better than his outſet had promiſed. But, in the year 1793, he was attacked with an illneſs, which proved fatal in about a fortnight.

M. St Bel left behind him ſeveral works, viz. An Eſſay on the Geometrical Proportions of Eclipſe. Lectures on the Elements of Farriery. The art of Horſeſhoeing, with Obſervations on the Diſeaſes of the Feet. And a volume of poſthumous works.

We do not pretend to give our own opinion as to the merits of theſe works, as we have not ſeen them. But it is ſaid that the Eſſay is merely an application of the proportions long ago laid down by Bourgelat in his *Elemens d'Hippiatrique*, to a particular caſe; and that many of his meaſurements are incorrect. Mr Blaine roundly taxes him with tranſlating Lafoſſe to furniſh matter for his Elements, and refers for proof of this to the deſcription and treatment of *quittor* in St Bel's Elements, and Lafoſſe's *Dictionaire d'Hippiatrique*.

Mr Blaine brings many other inſtances of M. St Bel's want of information and ſcience, for which we muſt refer our readers to Mr Blaine's Outlines of the Veterinary Art.

74

On the death of M. St Bel, there appears to have been a competition for the vacant chair, between two gentlemen, who were both well qualified to fill it, Mr Edward Coleman and Mr Morecroft. Both of theſe gentlemen had been bred to ſurgery, and the former had acquired much reputation by an ingenious Eſſay on Suſpended Reſpiration. The latter was lately returned from France, where he had been ſtudying the veterinary art. We are not acquainted with the particulars

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culars of this competition; but the choice of the subscribers fixed on Mr Coleman, under whose management the college has acquired considerable reputation.

75 Mr Coleman appointed professor.

The election of Mr Coleman was followed by some new regulations. An anatomical theatre was fitted up, with dissecting rooms for the use of the students. A medical committee was also appointed for the purpose of examining the pupils, who had completed their education at the college, previously to their receiving a diploma as veterinary surgeons. This committee, in 1801, was composed of the following gentlemen.

76 Examining committee.

Dr Fordyce, senior physician to St Thomas's hospital.
Dr Relph, physician to Guy's hospital.
Dr Babington, Do.
Dr Bailie, physician to St George's hospital.
Mr Cline, surgeon to St Thomas hospital.
Mr Home, surgeon to St George's hospital.
Mr Astley Cooper, surgeon to Guy's hospital.
Mr Abernethy, surgeon to Bartholemew's hospital.
Mr Wilson, lecturer on anatomy and surgery; and
Mr Coleman, professor of the college.

The following are the regulations of this useful institution as published in the year 1801.

77 Regulations of the college:

The subscribers of the veterinary college pay two guineas per annum, or twenty guineas for life. For this subscription each subscriber is entitled to send, when sick or lame, any number of horses to the veterinary stables, where no charges are made for medicines, attendance, or operations. The subscriber pays only for the keep and shoeing of his horse, which is generally less than the actual expence incurred by the college. A committee of stablers is appointed to examine the quality of the forage, and to regulate the price of the keep of horses. For some years past, the subscribers paid only 2s. 6d. per night; but in consequence of the great advance in hay, corn, and straw, and the college, by this moderate charge, having sustained a considerable loss, the keep of horses is now fixed at 3s. per night. A separate committee inspects the accounts of the college, and three times in the year reports to the general meeting the state of the finances of the college. No horses but those the property of subscribers are admitted into the veterinary stables; but the professor is allowed private practice, and horses not belonging to subscribers may be sent to the college for the professor's opinion.

The horses not intended to be left in the stables of the college may be sent for the professor's advice on Mondays, Wednesdays, and Fridays, from twelve to two o'clock. Where medicines are requisite, they are prepared for subscribers horses at very reduced prices; and the college receives all emoluments which may arise from the sale of horse medicines.

The expences incurred by subscribers, for shoeing, for the keep of horses, or for medicines, must be paid for before the animal be taken from the college. And as some losses have been sustained from the strict letter of this regulation not having been always attended to, the clerk has now received positive orders from the committee, not to allow any horse, before all the expences are paid, to be taken from the college. The horses are placed under the direction of the professor, who resides on the spot, and the medicines he prescribes are compounded by a proper person employed for that purpose.

As the great object of the veterinary establishment is to form a national school for the improvement of farriery, pupils paying twenty guineas are admitted into the college to learn the veterinary art. History.

Lectures are given by the professor on the formation, economy, and diseases of horses, and other domestic animals; and most of the eminent medical teachers in London, with a liberality peculiar to themselves, have allowed the veterinary pupils to hear their lectures without any fee or reward. The veterinary students attend lectures on human anatomy and physiology, on the principles and practice of surgery, on the materia medica, and chemistry, and practice of physic.

The period requisite for obtaining a competent knowledge of the veterinary art, is regulated by the talents, previous information, and industry of the individual pupil. The students continue to attend the college until they are examined and approved by the medical committee. Those pupils who are duly qualified receive a diploma; but those who are found on examination to be deficient, are rejected. There are four general examinations in the year. When examined and approved, if no objections are made to their conduct, during their study at the veterinary college, they may be recommended to any regiment of cavalry, not already provided with a veterinary surgeon.

No fees of any kind are allowed by the college to any of the servants of subscribers; neither are the servants of the college permitted to receive any perquisites from the subscribers.

A veterinary college has also been established near Birmingham, and it is said that others are in contemplation in other parts of the empire.

The advantages that have already accrued from this establishment, to veterinary medicine in general, and to our national cavalry in particular, are very considerable. Almost every regiment of cavalry has been supplied from the college, with a veterinary surgeon; and many of these gentlemen have published works which, for the most part, do much credit to themselves and their academy.

In 1798, Mr Coleman published the first volume, and in 1802, the second, of Observations on the Structure, Oeconomy, and Diseases of the Foot of the Horse. This is a most useful and valuable work, but it is too splendid and costly, especially the second volume, for general circulation. The first volume contains a very full account of the method of shoeing practised at the veterinary college, of which we shall give an abstract hereafter.

About this period, appeared also a pamphlet by Mr Coleman, On the Formation and Uses of the natural Frog of the Horse, with the description of an artificial Frog.

In 1801, appeared the first number of the Veterinary Transactions, published by order of the subscribers. This pamphlet commences with a long introduction, stating the object of the institution, the progress which it had made, and the causes that tended to prevent its complete success. These originate partly in the party opposition of the common farriers, who deem it their interest to do all in their power to circumvent the views of the subscribers: but they have still more been derived from the underhand malice of grooms and servants, with whose interest the institution, from the liberal manner in which

History. which it is conducted, muſt certainly claſh. The body of the pamphlet is occupied with a very neat view of the conſequences and treatment of wounds of joints, and other circumſcribed cavities, and it is concluded by an account of the regulations of the college (ſee N° 77.) the liſt of the medical committee, a liſt of the examined and approved veterinary ſurgeons that had at that time paſſed at the college, and liſts of the then managers and ſubſcribers to the inſtitution.

78 Bracey Clarke. The firſt pupil of the college, as we believe, who diſtinguiſhed himſelf as an author, was Mr Bracey Clarke; who, in the third volume of the Linnean Tranſactions, publiſhed a very ingenious paper on the *botts* in horſes and cattle, of which we ſhall ſpeak hereafter.

79 Riding. About the ſame time appeared a ſmall volume on Veterinary Pathology, by Mr Riding, veterinary ſurgeon to the 18th regiment of dragoons.

80 Denny. In 1802, Mr John Denny, of the 10th dragoons, publiſhed a ſmall volume on the Diſeaſes of Horſes. In this work Mr Denny has in general given the principles and practice of the veterinary college, and has illuſtrated and confirmed theſe by his own attentive obſervations and long experience.

81 White. In the ſame year appeared a very neat Compendium of the Veterinary Art, by Mr James White of the 1ſt Dragoons. This is only a pocket volume, and of courſe is very conciſe; but the author has given a very comprehenſive view of the nature and treatment of diſeaſes, and of the late improvement in the art of ſhoeing introduced into the veterinary college; and the work will be found an uſeful companion to the young practitioner. This volume alſo contains the ſubſtance of a former work, by the ſame author, on the Anatomy and Phyſiology of the Horſe's Foot. In the year 1804, Mr White publiſhed the Veterinary Materia Medica, containing a brief deſcription of the various ſubſtances employed in farriery, with an account of their particular effects on the body of the horſe. He occaſionally introduces ſome pertinent remarks on the diſeaſes of the horſe; and in the latter part of the volume, compriſing the veterinary pharmacopeia, he has given a number of the beſt and moſt ſcientific recipes that he had ſeen. This work may be conſidered as the ſecond volume of Mr White's compendium; and the author conſidered the two volumes, as forming a complete ſyſtem of the veterinary medicine. Though we are diſpoſed to think very favourably of theſe volumes, as a practical compendium, we cannot help thinking that Mr White might have contented himſelf with that modeſt title without aſſuming the more pompous one of a ſyſtem. We muſt alſo remark, that the materia medica, which is not large, is unneceſſarily ſwelled by the admiſſion of many articles that ſeem to have been introduced merely to tell us, that they are never uſed in the veterinary practice.

Mr White is alſo the author of an Addreſs to the Royal Firſt Devon Yeoman Cavalry reſpecting the management of their horſes, when employed on actual ſervice.

82 Richard Lawrence. In the year 1802, or we believe a little earlier, a work of conſiderable elegance was publiſhed by Mr Richard Lawrence, veterinary ſurgeon at Birmingham. As we have not ſeen this work, we muſt copy the following account of it from Mr Blaine. "It is much to be regretted that a gentleman who poſſeſſes ſo much ingenuity, ſhould paſs over ſubjects of ſuch importance in ſuch a light curſory manner. The deſcription and treatment of ſome diſeaſes occupy fewer lines than (to treat the ſubject in ſuch manner as to prove uſeful) they would require pages. The plates are elegant, and extremely well deſigned, particularly thoſe that regard the proportions and paces of the horſe; thoſe that regard the internal ſtructure and diſeaſes are not ſo happy. The diction is very ſuperior. As a cabinet work, it is moſt certainly elegant and intereſting; but as a uſeful aſſiſtant to the art itſelf, it does not rank ſo high." History.

83 Boardman. In the ſame year was publiſhed the firſt part of a dictionary of the veterinary art by Mr Thomas Boardman of the third regiment of Dragoons. This work was intended to be completed in ſixteen parts. The author ſeems to have availed himſelf of the lateſt and beſt information on the ſeveral articles that compoſe his work; and he has introduced into it a variety of ſubjects on the principles of general medicine.

84 Feron. One of the lateſt publications by pupils of the veterinary college, is a new ſyſtem of farriery by Mr John Feron, veterinary ſurgeon to the thirteenth regiment of Light Dragoons. This work is printed in quarto, and affords a good inſtance to what an extent a ſmall quantity of matter may be carried by the modern typographical improvements of large type, broad margins, wide ſpaces, and frequent breaks. The work is indeed very elegant both in type, and in plates. It alſo contains ſome uſeful information on the external ſtructure of the horſe, with a view to point out and illuſtrate what appeared to the author to be the moſt perfect form of a blood horſe, with the blemiſhes and defects which appeared moſt likely to impede his velocity. This appears to be the beſt part of the work, and is well illuſtrated by the plates. The latter half of the book is occupied with the conſideration of diſeaſes; and here we are led, from the author's title page, to expect an account not only of the diſeaſes of horſes, but of the principal epidemics to which cattle, ſheep, &c. are ſubject. Theſe epidemics are however diſcuſſed in the courſe of ſeventeen pages; but we are given to underſtand that the author intends in a future publication to give a full comparative deſcription, with the proper mode of treatment of every diſeaſe that affects domeſtic animals. Mr Feron's obſervations are rendered of much leſs utility than they would otherwiſe have been, by the want of a proper index, or table of contents.

85 Freeman. Theſe are, we believe, the principal publications that have proceeded from the pupils of the veterinary college. A few other works on veterinary medicine ſtill remain to be conſidered. In 1796, a very elegant work on horſes was publiſhed by S. Freeman, Eſq. whoſe character is given by Mr Blaine as an amateur in the manege, and a gentleman of fortune, learning and great ingenuity. This publication conſiſted in a *deſcription of the ſtructure and economy of the foot*, accompanied with a ſet of plates highly finiſhed in Skelton's beſt ſtyle. The ſubjects were diſſected under the inſpection of Mr Home, or an aſſiſtant; and except ſome ſlight errors in the ligaments of the navicular bone, appear very correct. This publication, for the elegance of its engravings, and the general ſpirit of the whole, will be long without a competitor. It recommends a very ingeni-

History.

ous mode of ſhoeing, and the economy of the foot is likewiſe very ingenious.

86 John Lawrence.

About the ſame time Mr John Lawrence publiſhed a ſmall volume on horſes, chiefly compoſed of extracts from St. Bel, Oſmer, Clarke, and Lord Pembroke; and in 1798, this gentleman brought forward his philoſophical and practical treatiſe on horſes, a work which is as remarkable for the good ſenſe and humanity of the author, as for the whimſical eccentricity and angry irritability which he occaſionally diſplays. The work embraces a great variety of ſubjects. It commences with an account of the principal former writers on farriery, in which high eulogies are paid to the memory of Gibſon and Bracken, and a very violent attack is made on the ill-ſtarred Mr Taplin. The latter part of the work contains Mr Lawrence's ſyſtem of veterinary practice, which is chiefly taken from his favourite authors, as Mr Lawrence ſeems at that time not to have had much practical experience. The work alſo contains ſome remarks on the diſeaſes of horned cattle, on the treatment of cows, and on calving,

Mr Lawrence has ſince, in 1805, publiſhed a ſeparate treatiſe on cattle, in which the management of neat cattle, ſheep, and ſwine, are handled in a maſterly manner; and a much fuller account of diſeaſes and their treatment is given than could be expected in his former treatiſe. We venture to recommend Mr Lawrence's works as amongſt the moſt inſtructive and moſt entertaining that we have met with.

87 Downing.

Some years ago there appeared a work on the deſcription and treatment of the diſeaſes of cattle, by a Mr Downing, a profeſſor of cattle medicine; which, though very expenſive, ſold very faſt, and was very generally eſteemed amongſt farmers and graziers. We have not ſeen this work; but from the account of it that is given by Mr Blaine in his outlines, it ſhould ſeem that it abounds with important errors, and frequently inculcates a dangerous mode of practice. We cannot here enumerate the particular examples brought by Mr Blaine in proof of his aſſertions, but we ſhall notice the moſt important of them under their proper heads.

Perhaps no part of veterinary medicine has been ſo little cultivated in this country, as that which conſiders the diſeaſes of cattle. There is ſcarcely a work on this ſubject in the Engliſh language that is worth peruſal. We cannot give a better idea of the little value that muſt be placed on theſe works than by the following extract from Mr Lawrence's treatiſe on cattle.

88 Imperfection of works on cattle medicine.

"I have never yet ſeen any of theſe *cattle doctoring books*, which appeared to me to be written *bona fide*. Well-intentioned ignorance, if not entitled to reſpect, is at leaſt venial; but the ſlighteſt examination of moſt of theſe printed guardians of the health of cattle, by a perſon qualified to judge, will evince, that they are premeditated impoſtures, goods merely varniſhed up for ſale. They have either the names of living men tacked to them, who, in the ſtrongeſt probability, never either did, or could write a line of them, or they are publiſhed in the name of ſome one of the mighty dead, among cow-doctors, who moſt unfortunately died at laſt, after ſixty years practice. One would expect to find ſomething original and valuable, from this long-continued and extenſive practice; but the diſappointment is always complete. The chief of that which we meet with, conſiſts of tranſcriptions from former writers, interlarded with learned, medical, and phyſical diſſertations, perhaps ſound and good enough in their place, to which are looſely and clumſily tacked the moſt nonſenſical and burleſque appendages by Mr Editor. The medicinal forms in theſe books, are frequently the ſtrangeſt jumble that imagination can conceive. Articles of a directly oppoſite nature and intention, are blended in one maſs, which muſt inevitably act upon the animal ſyſtem with an effect ſimilar to that of two men pulling at oppoſite ends of a cord. We find balſam of Peru and Glauber's ſalts married together, the intent of which, no doubt muſt be, as a Suffolk farrier once deſcribed to the late Mr Ruſh, "a kind of heater, and a kind of cooler." Indeed the far greater number of the preſcriptions wear rather the appearance of having been fabricated for the uſe of the book, than of having ever been uſed and approved in real practice. One truly laughable cuſtom was introduced by the book publiſhed under the name of Topham's old one. It was to ſubjoin to every preſcription of note, a ſet character, conceived in the moſt high ſounding terms of panegyric, at the ſame time, with a choice of words, at once ſo droll, and ſo gravely profeſſional, with ſo formal an arrangement, that he muſt be a man far ſurpaſſing me in gravity, grave as I naturally am, who can peruſe them without burſting into laughter. It muſt not be denied, however, that theſe books contain a number of uſeful hints, relative to the management and dieting of cattle, whether or not ſuch may have originated with the doctor, or have been introduced by the editor. They may alſo, to a certain degree, be conſulted as to the ſymptoms of diſeaſes, although by no means to be implicitly relied on even in that reſpect. So far they have their uſe. With regard to doctoring, as it is termed, or preſcribing medicines to cattle, they are moſt truly blind guides; and when, unfortunately, they are ſet to lead the blind, the fate of both parties may be very readily anticipated. I am ſpeaking of books, which have been publiſhed within the laſt half century. As to the ancient veterinary writers, none of them, not even the celebrated Vegetius, were medical men, and their medical practice is utterly beneath modern notice. The ſame kind of books of our old Engliſh writers, conſiſt of a ſtrange medley of ancient practice with various ſage additions of their own. A rational man cannot read over ſome of their preſcriptions without amazement, nor a humane one without extreme pity for the haraſſed victim of ſuch monſtrous practice. By the way, they who, for intereſted purpoſes, fabricate pretended cattle medicines, of the effects of which they are careleſs or ignorant, commit an act of groſs inhumanity and crime, in too probably adding to the load of ſufferings of a helpleſs animal already tortured by diſeaſe. One of the greateſt curioſities we meet with in the old books, is their grand univerſal ſpecific. It ſeems as though they judged by a kind of compound arithmetico-medical logic, that all medicines being conjoined and multiplied one into the other, the product muſt neceſſarily be the prevention or cure of all diſeaſes." * Lawrence on Cattle. 9

Mr Lawrence has excepted from the above general condemnation, a work lately publiſhed by Mr Culley, of Northumberland; which, he ſays, ought to be in the hands of every farmer in Great Britain. He conſiders it as the only original work in our language, and, as containing in a ſmall compaſs, a moſt valuable fund of information. Culley.

History. information, chiefly from the author's own experience.

92 Morecroft. In the year 1800, Mr Morecroft, the rival candidate with Mr Coleman for the profeſſorſhip of the veterinary college, publiſhed a ſmall pamphlet containing a curſory account of the various methods of ſhoeing horſes, with incidental obſervations. This work diſplays conſiderable ingenuity. We ſhall notice Mr Morecroft's method of ſhoeing by and by.

91 Blaine. In 1802, appeared Mr Blaine's Outlines of the Veterinary Art, or the Principles of Medicine as applied to a knowledge of the ſtructure, functions, and economy of the horſe, the ox, the ſheep, and the dog; and to a more ſcientific and ſucceſsful manner of treating their various diſeaſes; in two volumes. Mr Blaine is well known as a practitioner of veterinary medicine, and as the advertiſer of a ſpecific againſt the diſtemper in dogs. In his Outlines, Mr Blaine, after giving a ſketch of the hiſtory of medicine in general, enters on the hiſtory of veterinary medicine in particular, which he details at conſiderable length; not however, without ſeveral errors, ſome of which we have already pointed out. He next proceeds to lay down very briefly what he conceives to be the proper means for the attainment of the veterinary art. Then follows a long ſection on a ſubject which we ſhould ſcarcely expect to find in a work of this kind, the hiſtory of chemiſtry. The firſt part concludes with a ſketch of comparative anatomy, in which the ſtructure and economy of the ox, ſheep, and dog are paſſed over much too lightly. The ſecond part, which occupies the reſt of the firſt volume, and one-half of the ſecond, is taken up with a very minute account of the anatomy of the horſe, with ſome obſervations on the economy and uſes of the ſeveral parts. We conſider this as the beſt part of Mr Blaine's book; but we think that he has made it unneceſſarily prolix, as by carrying it to ſuch an extent, he has not left room for a ſatisfactory account of diſeaſes, which occupy the reſt of the ſecond volume. Here we cannot but conſider the author as very defective. Neither the ſymptoms nor the treatment are given with that accuracy or preciſion, which the public had a right to expect from a practitioner of Mr Blaine's long experience. Many of the diſeaſes of cattle, ſheep, and eſpecially of dogs, are paſſed over in a manner that is by no means ſatisfactory. The work is written in a very ſlovenly manner, and is everywhere filled with an oſtentatious parade of medical phraſeology that muſt render it nearly unintelligible to the generality of readers. In his receipts, Mr Blaine has for the moſt part adopted the new nomenclature, which, however we may approve in medical formulæ, we cannot think calculated for the meridian of farriers. We, however, by no means intend to inſinuate that Mr Blaine's work is without merit: it certainly contains much valuable matter; but we muſt repeat that it is not what we ſhould have expected from the advantages of information and experience which Mr Blaine appears to have poſſeſſed. History.

In the following year, Mr Blaine publiſhed a ſmaller work, which he calls a Domeſtic Treatiſe on the diſeaſes of horſes and dogs, which appears to be chiefly an abridgement of the Outlines, with a ſort of advertiſement for the ſale of Mr Blaine's patent medicine.

92 Findlater. In 1802 appeared a General View of the Agriculture of the county of Peebles, by the Rev. Charles Findlater, miniſter of the pariſh of Newlands, in that county. This work, though intended merely as a local ſurvey of the ſtate of agriculture and improvements in a ſmall diſtrict, abounds with much excellent matter that muſt prove of general utility. Beſides the obſervations which the ingenious author has made, on the general management of live ſtock, in the body of his work, he has added in one of his appendices ſome valuable information reſpecting ſome of the moſt important diſeaſes of ſheep, which are partly furniſhed from the communications of Dr Gilleſpie, late phyſician in Edinburgh, and Dr Coventry profeſſor of agriculture in that univerſity, and partly derived from his own experience.

93 Dickſon. In 1803 was publiſhed an elegant work on practical agriculture by Dr R. W. Dickſon; the ſecond volume of which contains much uſeful inſtruction reſpecting the choice, breeding, feeding, &c. of all the ſpecies of live ſtock employed on a farm; with a few very conciſe remarks on the diſeaſes of each ſpecies. But as theſe are merely practical hints, they cannot be of much uſe, except to thoſe who are already tolerably acquainted with the ſubject.

94 Daniel. In the ſame year, the Rev. William Daniel performed a taſk, which, however ill ſuited to the character and avocation of a clergyman, muſt be highly grateful to every lover of the ſports of the field, in the publication of his Rural Sports, which contains perhaps the moſt complete account of every thing relating to dogs that is to be found in the Engliſh language. Among other ſubjects connected with the management of this favourite companion of man, the reverend author takes occaſion to treat pretty fully of his diſeaſes. On this ſubject, Mr Daniel has not only collected matter from what he conceives to be the beſt ſources, but, what is more uſeful, as well as more to be depended on, he has added much from his own obſervation and experience.

95 Harriſon. One of the lateſt works on the diſeaſes of domeſtic animals, which we have ſeen, is An Enquiry into the Rot in Sheep, and other animals, by Dr Edward Harriſon, a reſpectable phyſician of Horn-caſtle, in Lincolnſhire. Of this pamphlet we ſhall ſpeak at large, when we come to treat of the diſeaſe, whoſe nature and cauſes it is intended to illuſtrate.

PART II. ON THE STRUCTURE OF THE HORSE.

96 IN the ſketch which we are to give of the anatomy of the horſe, we muſt very lightly paſs over ſuch parts as appear not to be of immediate importance in the practice of farriery, in order to dwell more minutely on thoſe organs that are of greater conſequence. Thus we ſhall content ourſelves with giving a tabular view of the bones and muſcles; we ſhall entirely omit the brain and nerves; but we ſhall deſcribe ſome of the other viſcera, as the ſtomach, and the bowels, ſomewhat more minutely. We ſhall be moſt particular on the anatomy of the extremities, eſpecially of the feet, as on an accurate knowledge of theſe parts depend the principles of ſhoeing;

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ing; which, without ſuch knowledge, cannot be properly underſtood, or rationally practiſed.

On the ſubject of the anatomy of the foot, we ſhall be particularly indebted to the writings of Mr Coleman; and we cannot ſhew the importance of the ſubject in ſhoeing better than by the following remarks of that gentleman.

97 Importance of an accurate knowledge of the anatomy of the foot.

"The organization and functions of the foot of the horſe will be found rather complicated; but it is of conſiderable importance to thoſe who wiſh to inveſtigate the principles, as well as the practice of ſhoeing, to be well acquainted with every part of that organ. The practical part of ſhoeing is often well executed without an accurate knowledge of the contents of the hoof.

"But, in many caſes, it is very neceſſary to be well acquainted with the ſtructure and functions of the deeper ſeated parts, and is moſt particularly uſeful for the removal of many diſeaſes incident to the foot. The immenſe weight ſupported by the feet of the horſe, and the rapidity with which this great animal is conveyed from place to place, without violence to the external or internal parts of the foot, naturally excite a deſire to aſcertain the cauſe of ſo wonderful an effect. If the human foot ſupported the ſame weight as the foot of the horſe, the ſenſible parts would be deſtroyed. Without ſprings, no external covering could effectually ſupport the weight, and prevent the foot from being ſmaſhed. The phyſiologiſt will receive infinite ſatisfaction in the inveſtigation of the functions of this complicated organ; he will find as much order and beauty, as much wiſdom and utility, in the formation and economy of the foot, as ever was diſplayed in the ſtructure and uſes of any animal. It will be ſeen in many inſtances, that the ſame part performs various functions, and all of theſe functions well *".

* *Coleman on the Horſe's Foot*, vol. ii.

98

In our deſcription of the ſtructure of the horſe, we ſhall, as far as poſſible, employ Engliſh names to denote the parts deſcribed or enumerated, as we think the writers on this ſubject have done wrong in giving to the parts of the horſe the Latin names that are employed in the human anatomy; and we have no doubt that the generality of veterinary ſtudents muſt, from this circumſtance alone, be in a great meaſure deterred from paying the neceſſary attention to ſo important a ſubject. But, that we may avoid affectation, we ſhall, wherever it appears neceſſary, add the correſponding Latin name, and ſome ſynonyms of the more reſpectable writers on the anatomy of the horſe.

CHAP. I. *A Sketch of the Bones of the Horſe.*

99 Skeleton.

WHEN we take a general view of the ſkeleton of the horſe, ſuppoſed to ſtand before us, we ſhall obſerve that, excepting the head and forepart of the neck, the ſkeleton forms nearly a ſquare, and approaches more nearly to this form, as the body of the animal is more exactly proportional. We remark this for the ſake of painters and ſculptors, who commonly err conſiderably with reſpect to their proportion of length and breadth in their figures of the horſe.

We ſhall divide the ſkeleton into the head, the ſpine, the trunk, and extremities. See Plate CCXI. fig. 1.

1. BONES of the HEAD. A.

a, *c*, Half of the *frontal bone*, which in the horſe is always compoſed of two pieces.

e, *f*, One of the two *parietal bones*.

g, *h*, *i*, *k*, The *occipital bone*, with a proceſs at *k*, that is peculiar to the horſe.

l, *m*, The *temple*, or *temporal bone*, of one ſide; *m*, the cheek-bone of one ſide.

o, One of the ſmall bones within the ſocket of the eye, that anſwers to the *os unguis* in man.

p, *p*, Bones of the noſe.

q, *r*, *s*, The upper jaw-bone.

t, The *intermaxillary* bone, or what is uſually called by veterinary writers the *inferior* jaw-bone. This is not found in the human ſkeleton.

u, *v*, The poſterior maxillary bone, which anſwers to the lower jaw-bone in man.

BONES of the SPINE. B.

1, 2, 3, 4, 5, 6, 7, The ſeven vertebræ of the neck.

a, The atlas; *b*, the ſecond vertebra, called in human anatomy, *dentata*; *d*, *e*, *f*, its tranſverſe proceſs; *e*, its oblique proceſs; *f*, its ridge, anſwering for a ſpinous proceſs; *g*, *h*, *i*, *k*, *l*, *m*, *n*, third cervical vertebra; *g*, its body; above the letter is the hole for the tranſmiſſion of the vertebral arteries and veins; *i*, *k*, anterior and poſterior tranſverſe proceſſes; *l*, a protuberance in the fore part of the body.

8—25, The eighteen vertebræ of the back; *a*, the body of each; *b*, the tranſverſe proceſſes that articulate with the ribs; *c*, the oblique proceſſes; *d*, the ſpinous proceſſes.

26 to 30, The five vertebræ of the loins, which have very long tranſverſe proceſſes, though theſe are not very eaſily diſtinguiſhed in the figure, from its having a ſide view.

x, *x*, The ſacrum bone, compoſed of five pieces, as in man.

From 31 to 43, the 13 bones compoſing the tail, anſwering to the *os coccygis* in man.

BONES of the TRUNK. C.

a, *b*, 1, 9, The true ribs; 10 to 18 the falſe ribs; *a*, the head articulating with the tranſverſe proceſs of the firſt dorſal vertebra; under is ſeen the lower branch of the head that unites with the ſeventh cervical and firſt dorſal vertebra; *c*, the end that unites with the ſternum or breaſt-bone; *a*, *b*, *c*, *d*, *e*, *f*, *g*, the two hip-bones, anſwering to the *oſſa innominata* in the human anatomy; *a*, *b*, *c*, the ilium, with its tuberoſity *a*, forming the haunch or hip; *e*, *f*, the iſchium; *g*, *g*, the pubis with its juncture or ſymphyſis between the two letters.

BONES of the FORE EXTREMITY. D. D.

e, *f*, *g*, *h*, *i*, *l*, *m*, The ſcapula or blade-bone; *e*, its neck, below which is ſeen its glenoid cavity; *f*, anteſpinatus foſſa; *h*, its ſpine, which in the human ends in the proceſſus acromion, but as there is no clavicle in the horſe, it ends by a tuberoſity; *i*, coracoid proceſs; between *m* and *i*, the anterior coſta; *l*, between this and *e*, poſterior coſta; between *m* and *l*, is its baſe, and the line above it marks the extent and ſituation of the cartilage of the ſcapula; *n*, *o*, *p*, *q*, humerus or arm; *n*, its neck, above which is ſeen its head; *o*, its anterior head, forming the point of the ſhoulder, as it is commonly called

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called in the horſe; *p*, its tuberoſity; *q*, its lower head, behind is ſeen the cavity for the reception of the olecranon; *r*, *r*, ulna; the upper part forms the olecranon or elbow, the lower part is united by ligamentous fibres to the radius; *s*, *s*, the radius; 1, 2, 3, 4, 5, 6, 7, the carpus or knee; 1, 1, piſiform; 2, 2, ſcaphoid; 3, 3, lunar; 4, unciform; 5, magnum; 6, cuneiform; 7, trapezoid; *t*, *u*, metacarpus; *t*, canon; *u*, two ſmall metacarpals; *v*, *w*, *x*, *y*, *z*, phalanges; *v*, firſt phalanx or paſtern; *w*, ſeſamoids; *x*, coronet-bone, or little paſtern; *y*, coffin; *z*, navicular or nut-bone.

Bones of the Hind Extremity. E. E.

h, *i*, *k*, *l*, *m*, Thigh-bone; *h*, the neck, above which is the head received into the ſocket of the pelvis; *i*, great trochanter; *k*, the outer trochanter; *l*, *l*, the inner trochanter; *m*, *m*, the anterior condyles; *n*, *n*, the poſterior ditto; *p*, *p*, ſemilunar cartilage; *o*, *o*, knee-pan or patella; *g*, tibia or leg-bone, commonly called the thigh; *r*, fibula; the tibia is ſeen terminating in its maleoli, to articulate with the tarſus; 1, 2, 3, 4, 5, 6, 7, 8, tarſus or hock; 1, 2, 1, 2, calces, forming the point of hock, in man the heel; 3, 4, aſtragalus; 5, 5, great cuneiform bone; 6, cuboid bone; 7, middle cuneiform bone; 8, ſmall cuneiform bone; *s*, *s*, *t*, *t*, metatarſus; *s*, *s*, canon or ſhank; *t*, *t*, two ſmall metatarſals; *u*, paſtern; *v*, ſeſamoids; *w*, coronet-bone or leſſer paſtern; *x*, *x*, coffin-bone; *y*, navicular or nut-bone.

Of the Teeth.

100 Teeth.

A male horſe has 40 teeth, when he has completed his full number. The mare has uſually but 36. They are divided into three kinds; the cutting teeth or nippers; the cuſpidatæ or tuſhes, and the molares or grinders. A knowledge of the horſe's teeth and of the changes which they undergo, from their firſt appearance, is of the greateſt conſequence, as from it we derive the ſureſt marks of the age of the horſe; at leaſt, till he is eight or nine years old.

Figs. 2, 3, 4, 5, 6, 7, and 8, ſhew the appearance of the teeth from their firſt cutting to the age of eight years.

Fig. 2. ſhews the appearance of the colt's teeth at the age of three weeks; fig. 3. that of the colt's teeth at three months. Fig. 4. ſhews the ſtate of the teeth from three months to about four or five years, where *a*, *a*, are the pincers or nippers; *b*, *b*, what are called the ſeparators; *c*, *c*, the corners, or the laſt of the front teeth at that age; *d*, *d*, the tuſks. Fig. 5. ſhews the appearance of the teeth at the age of five years, and figs. 6, 7, and 8, their appearance at the reſpective ages of ſix, ſeven, and eight years.

101 Means of aſcertaining the age of a horſe.

The age of a horſe is eaſily known by his mouth, till he comes eight, after which the uſual marks wear out. A horſe, like many other brute animals, has his teeth divided into three ranks; viz. his fore-teeth which are flat and ſmooth, his tuſhes, and his back-teeth. His back-teeth or jaw-teeth are called his grinders, being thoſe by which a horſe chews and grinds his provender, and are 24 in number, 12 above and 12 below: they are ſtrong double teeth, with ſharp edges; but when a horſe grows old they wear much ſmoother.

The firſt that grow are his foal-teeth, which begin to appear a few months after he is foaled: they are 12 in number, ſix above and ſix below; and are eaſily diſtinguiſhed from the teeth that come afterwards by their ſmallneſs and whiteneſs, not unlike the fore-teeth of a man.

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When the colt is about two years and a half old he caſts the four middlemoſt of his foal-teeth, viz. two above and two below: but ſome do not caſt any of their foal-teeth till they are near three years old. The new teeth are eaſily diſtinguiſhed from the foal-teeth, being much ſtronger, and always twice their ſize, and are called the inciſors or gatherers, being thoſe by which a horſe nips off the graſs when he is feeding abroad in the fields, or in the houſe gathers his hay from the rack. When a horſe has got theſe four teeth complete, he is reckoned three years old.

When he is about three and a half, or in the ſpring before he is four years old, he caſts out four more of his foal-teeth, viz. two above and two below, one on each ſide the nippers or middle teeth: ſo that when you look into a horſe's mouth, and ſee the two middle teeth full grown, and none of the foal-teeth except the common teeth remaining, you may conclude he is four that year about April or May. Some indeed are later colts, but that makes little alteration in the mouth.

The tuſhes appear near the ſame time with the four laſt mentioned teeth, ſometimes ſooner than thoſe, and ſometimes not till after a horſe is full four years old: they are curved like the tuſhes of other beaſts; only in a young horſe, they have a ſharp edge all round the top and on both ſides, the inſide being ſomewhat grooved and flattiſh, inclined to a hollowneſs.

When a horſe's tuſhes do not appear for ſome time after the foal-teeth are caſt and the new ones come in their room, it is generally owing to the foal-teeth having been pulled out before their time by the breeders or other dealers in horſes, to make a colt of three years old appear like one of four, that he may be the more ſaleable; for when any of the foal-teeth have been pulled out, the others ſoon come in their places; but the tuſhes having none that go before them, can neve make their appearance till their proper time, viz. when a horſe is about four or coming four; and, therefore, one of the ſureſt marks to know a four years old horſe is by his tuſhes, which are then very ſmall and ſharp on the top and edges.

When a horſe comes five, or rather in the ſpring before he is five, the corner teeth begin to appear, and at firſt but juſt equal with the gums, being filled with fleſh in the middle. The tuſhes are alſo by this time grown to a more diſtinct ſize, though not very large; they likewiſe continue rough and ſharp on the top and edges. But the corner teeth are now moſt to be remarked; they differ from the middle teeth in being more fleſhy on the inſide, and the gums generally look rawiſh upon their firſt ſhooting out; whereas the others do not appear in this way. The middle teeth arrive at their full growth in leſs than three weeks; but the corner teeth grow leiſurely, and are ſeldom much above the gums till a horſe is full five: they differ alſo from the other fore-teeth, in this, that they ſomewhat reſemble a ſhell; and thence are called the ſhell-teeth, becauſe they environ the fleſh in the middle half-way round; and as they grow, the fleſh within diſappears, leaving a diſtinct hollowneſs and openneſs on the inſide. When a horſe is full five, theſe teeth are generally about the thickneſs of a crown-piece about the gums. From five to five

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and a half they will grow about a quarter of an inch high, or more; and when a horſe is full ſix, they will be near half an inch, and in ſome large horſes a full half-inch, about the gums.

The corner teeth in the upper jaw fall out before thoſe in the under, ſo that the upper corner teeth are ſeen before thoſe below; on the contrary, the tuſhes in the under gums come on before thoſe in the upper.

When a horſe is full ſix years old, the hollowneſs on the inſide begins viſibly to fill up, and that which was at firſt fleſhy, grows into a browniſh ſpot, not unlike the eye of a dried garden bean, and continues ſo till he is ſeven; with this difference only, that the tooth is more filled up, and the mark or ſpot becomes faint, and of a lighter colour. At eight, the mark in moſt horſes is quite worn out, though ſome retain the veſtiges of it a long time; and thoſe who have not had a good deal of experience, may ſometimes be deceived by taking a horſe of nine or ten years old for one of eight. It is at this time only, when a horſe is paſt mark, that one can eaſily err in knowing the age of a horſe; for what practices are uſed to make a very young horſe or colt appear older than he is, by pulling out the foal-teeth before their time, may be diſcovered by feeling along the edges where the tuſhes grow, for they may be felt in the gums before the corner teeth are put forth; whereas, if the corner teeth come in ſome months before the tuſhes riſe in the gums, we may reaſonably ſuſpect that the foal-teeth have been pulled out at three years old.

It will, perhaps, be needleſs to mention the tricks that are uſed to make a falſe mark in a horſe's mouth, by hollowing the tooth with a graver, and burning a mark with a ſmall hot iron; becauſe thoſe who are acquainted with the true marks, will eaſily diſcover the cheat by the ſize and colour of the teeth, by the roundneſs and bluntneſs of the tuſhes, by the colour of the falſe marks, which is generally blacker, and more impreſſed than the true mark, and by many other viſible tokens, which denote the advanced age of a horſe.

After the horſe has paſſed his eighth year, and ſometimes at ſeven, nothing certain can be known by the mouth. It muſt, however, be remembered, that ſome horſes have but indifferent mouths when they are young, and ſoon loſe their mark; others have their mouths good for a long time, their teeth being white, even, and regular, till they are 16 years old and upwards, together with many other marks of freſhneſs and vigour; but when a horſe comes to be very old, it may be diſcovered by ſeveral indications, the conſtant attendants of age, viz. his gums wear away inſenſibly, leaving his teeth long and naked at their roots. The bars of the mouth, which, in a young horſe are always fleſhy, and form ſo many diſtinct ridges, are, in an old horſe, lean, dry, and ſmooth, with little or no riſing. The eye-pits in a young horſe (except thoſe come of old ſtallions) are generally filled up with fleſh, look plump and ſmooth; whereas in an old horſe, they are ſunk and hollow, and make them look ghaſtly, and with a melancholy aſpect. There are alſo other marks which diſcover a horſe to be very old, viz. gray horſes turn very white, and many of them all over flea-bitten, except their joints. This, however, happens ſometimes later and ſometimes ſooner, according to the variety of colour and conſtitution.

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Black horſes are apt to grow gray over their eye-brows, and very often over a good part of their face, eſpecially thoſe who have a ſtar or blane fringed round with gray when they are young. All horſes, when very old, ſink more or leſs in their backs; and ſome horſes, that are naturally long-backed, grow ſo hollow with age, that it is ſcarce poſſible to fit them with a ſaddle. Of this kind are ſeveral Spaniſh and Barbary horſes, and many Daniſh and Flanders breed. The joints alſo grow ſtiff with old age, and their knees and hocks bend ſo, that they are apt to trip and ſtumble upon the leaſt deſcent, though the way be ſmooth and noways rugged. After which they can be of little uſe to the owner *.

* *Beardman's Dictionary.*

102 Muſcles.

CHAP. II. *Principal Muſcles of the Horſe.*

WE ſhall here only enumerate the muſcles of the head, neck, and trunk, as being of leſs importance than thoſe of the extremities. Of theſe latter we ſhall give a table, expreſſing, beſides their uſual names, their origin, inſertion, and uſes.

Muſcles of the Eyelids and Eye.

Orbicular of the eyelids.
Elevator of the upper eyelid, *a*, *b*, fig. 10.
Elevator of the eye.
Depreſſor of the eye.
Adductor of the eye.
Abductor of the eye.
Trochlear muſcle of the eye.
Obliquus major.
Leſſer oblique.
Retractor of the eye.

Muſcles of the Mouth and Jaws.

Orbicular, *g*, *i*, fig. 9. *o*, fig. 10.
Buccinator, *r*, fig. 9. *s*, fig. 10.
Elevator of the corner of the mouth, *m*, *n*, fig. 10.
Long naſal of the upper lip, *l*, *m*, *n*, *o*, fig. 9.
Maſſeter, *p*, *q*, fig. 9.
Ciliares, *u*, *w*, fig. 9.
Temporal, 2, 3, fig. 9.
Canine, 6, 7, fig. 9. *m*, *n*, fig. 10.
Depreſſor of the lower lip, 9, 10, fig. 9. *p*, *q*, *r*, fig. 10.
Elevator of the chin, 12. fig. 9.
Dilatators of the noſtrils, *a b c d*, *g f*, fig. 9.

Muſcles of the Neck.

Sterno-maſtoid; *a*, *b*, *c*, fig. 9.
Coraco-hyoideus, *f*, *f*, fig. 9. and *a*, *b*, *c*, *d*, *e*, fig. 10.
Sterno-hyoideus; *g*, fig. 9. *f*, *g*, fig. 10.
Sterno-thyroideus; *h*, *i*, *k*, fig. 10.
Tranſverſals; *h*, *i*, fig. 9. A, B, C, D, E, F, G, H, fig. 10.
Trachelo-maſtoid; M, O, P, Q, S, fig. 10.
Rectus internus major capitis; *m*, *n*, fig. 9. and *w*, *x*, *y*, fig. 10.
Intertranſverſales minores colli; *o*, fig. 9.

Long-

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Long muſcle of the neck; *p*, *q*, fig. 9. X, Y, fig. 10.
Splenius; *r*, *s*, *t*, fig. 9.
Hyothyroidæus; *y*, fig. 9.
Cricothyroidæus; ≈, fig. 9.
Lower conſtrictor of the pharynx.
Rectus capitis poſticus major; *t*, *u*, fig. 11.
minor; *x*, *w*, fig. 11.
Superior oblique of the head; *u*, U, fig. 10.
Inferior ditto; W, W, fig. 10.
Intertranſverſales poſteriores colli; L, &c. M, &c. fig. 11.
Intervertebral muſcles.
Multifidæ ſpinæ; *c*, *d*, fig. 12.
Spinales cervicis; R, T, U, fig. 11.

Muſcles of the Trunk.

External oblique; I, K, L, M, fig. 9.
Obliquus internus; *s*, *t*, *u*, *w*, *x*, *y*, fig. 10.
Rectus abdominis; ≈, fig. 10.
Tranſverſalis abdominis; *p*, *q*, *r*, fig. 11.
External intercoſtals; 1, 2, &c. fig. 11.
Internal, ditto; 3, 4, &c. fig. 11.
Semiſpinalis and ſpinalis dorſi; *a*, *b*, *c*, *d*, *e*, *f*, fig 11.
Longiſſimus dorſi; *g*, *h*, *i*, *k*, fig. 11.
Sacrolumbal; *l*, *m*, *n*, &c. fig. 11.
Elevators of the ribs; *a*, *b*, fig. 12.
Lateral of the tail; *e*, *f*, fig. 12.
Intertranſverſals of the tail; *g*, &c. fig. 12.
Elevator of the tail; *i*, fig. 12.
Depreſſor of the tail; *k*, fig. 12.

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103 Table of the muſcles of the extremities.

TABLE of the Muſcles of the Extremities.

1. *Muſcles of the Fore-leg and Foot.*

Name.	*Origin and Inſertion.*	*Uſe.*
Trapezius.	From the 4th, 5th, and 6th cervical vertebræ; from the firſt 12 or 13 dorſal vertebræ; and from the cervical ligament, into the ſpine of the blade-bone.	To raiſe and draw backwards the blade-bone.
Larger rhomboid. *Rhomboideus major.* *a b*, fig. 9. Triangulaire Vitet.	From the 3d, 4th, 5th, and 6th dorſal vertebræ, below the cartilage of the blade-bone, into the whole length of that cartilage.	To raiſe the blade-bone, and draw it a little forwards.
Leſſer rhomboid. *Levator ſcapulæ.*	From the ligament of the neck, at about the 2d vertebra, into the cartilage of the blade-bone.	To draw the blade-bone forward, when the neck is fixed, or *vice verſa*.
Leſſer pectoral. *Depreſſor ſcapulæ.* *c*, *d*, *e*, *f*, fig. 9.	From the lateral part of the breaſt-bone, into the upper and fore part of the blade-bone.	To draw the blade-bone downwards.
Triangular.	From the 4th, and 5th vertebræ of the neck, into the upper and fore part of the blade-bone, above the pectoral.	To draw the blade-bone forwards.
Anterior ſerrated. *Serratus anticus.* *g*, *h*, *i*, *k*, *l*, *o*, *p*, fig. 9.	From the true ribs, and from the 6th and 7th cervical vertebræ, into the laſt cervical vertebra.	To connect the blade-bone with the cheſt, and to draw it downwards, and ſometimes to aſſiſt other muſcles.
Ante-ſpinatus. *a*, *b*, *c*, *d*, *e*, *f*, fig. 9.	From the ante-ſpinatus foſſa, by two tendons, into the two tuberoſities of the head of the ſhoulder-bone.	To extend the fore-leg and move it forwards.
Poſt-ſpinatus. *h*, *k*, *l*, *n*, fig. 9.	From a foſſa, ſo called, into the outer-ſide of the ſhoulder-bone.	To move the fore-leg outward, and away from its fellow.
Extenſor of the ligament.	From the coracoid proceſs of the blade-bone, into the whole of the capſular ligament.	To prevent the ligament from being pinched between the bones.
Latiſſimus dorſi. *r*, *s*, *t*, *u*, *w*, fig. 9.	From all the dorſal vertebræ connected with the muſcles of the back, and with the fleſhy pannicle, into the inner tuberoſity of the ſhoulder-bone, below the blade-bone.	To draw the fore-leg backward, and towards the cheſt.
Common muſcle. *Levator humeri.*	From the tuberoſity of the temporal bone, and from the four firſt cervical vertebræ, into the upper and outward part of the arm.	To raiſe the arm, and when that is fixed, to draw the head and neck downwards.
Subſcapular. *a*, *b*, fig. 11.	From the hollow of the blade-bone, into the inner ſide of the ſhoulder-bone.	To move the arm towards its fellow.

Larger

Name.	*Origin and Inſertion.*	*Uſe.*
Larger pectoral. 1 2 3 4 5 6, fig. 9.	From the ſide of the breaſt-bone, and the cartilages of the ſix laſt true ribs, into the inner ſide of the ſhoulder-bone.	To draw the fore-leg downwards and backwards.
Sterno-brachial.	From the fore part of the breaſt-bone, into the inner and lower part of the ſhoulder-bone, and connected by expanſion with the radius.	To draw the fore-legs together, and to aſſiſt the laſt in reſpiration, when the fore-leg is fixed.
Coraco-brachial.	From the coracoid proceſs of the blade-bone into the lower and back part of the ſhoulder-bone.	To draw the arm forwards and outwards.
Adductor of the ſhoulder. *Teres major.* *d, e, f,* fig. 11.	From the upper part of the poſterior edge of the blade-bone, into the inſide of the ſhoulder-bone.	When the blade bone is fixed, to draw the fore-leg upwards and inwards, and *vice verſa.*
Long abductor of the ſhoulder. *Teres minor.* *o, p, q,* fig. 9.	From the poſterior edge of the blade-bone into the outer tuberoſity of the ſhoulder-bone.	To draw the ſhoulder-bone upwards and outwards.
Short abductor of the ſhoulder.	Below the laſt muſcle, between the laſt and the ſubſcapula.	To turn the arm.
Anterior radial flexor. *Flexor longus.* *Biceps in human anatomy.* *i, k, l, m, n,* fig. 10.	From the tuberoſity of the blade-bone, above the glenoid cavity, into the inner tuberoſity of the radius.	To bend the arm.
Oblique brachial flexor.	From the neck of the ſhoulder-bone into the inner tuberoſity of the radius.	To turn the fore-arm, and aſſiſt the former in bending it.
Faſcialis cubiti. *Extenſor longus.*	From the poſterior edge of the blade-bone into the olecranon, or elbow.	To bind down the muſcles, and aſſiſt in extending the arm.
Biceps extenſor cubiti. N, O, P, fig. 9.	From the whole length of the poſterior edge of the blade-bone into the olecranon.	To extend the arm.
Internal brachial. *a, b, c,* fig. 11.	Below the inner ſide of the head of the ſhoulder-bone, into the inner and upper part of the olecranon.	To oppoſe the oblique flexor.
Intermediate extenſor.	From the neck, and ſome part of the ſhoulder-bone, into the olecranon.	To aſſiſt in extending the arm.
Large extenſor of the canon.	From the outer condyle, and tuberoſity of the ſhoulder-bone, into the anterior tuberoſity of the canon-bone.	To extend the canon.
Radial extenſor of the canon. *a, b, c, d,* fig. 10.	From the ſide of the radius downwards from the middle, into the ſmall inner metacarpal bone.	To aſſiſt the former, and turn the foot outwards.
External flexor of the canon. *l, m,* fig. 11.	From the outer condyle of the ſhoulder-bone, at its back part, into the piſiform, and ſmall outer metacarpal bones.	To bend the canon.
Inner flexor of the canon. *n o p,* fig. 11.	From the inner condyle of the ſhoulder-bone, into the back part of the canon.	To aſſiſt the former.
Flexor of the carpus.	From the inner condyle of the ſhoulder-bone, at its back part, into the piſiform bone.	To bend the carpus, and extricate the ligament.
Anterior long extenſor of the foot.	From the lower and outer head of the ſhoulder-bone, and upper part of the radius, into the anterior protuberance of the coffin-bone.	To extend the foot.
The lateral extenſor of the foot.	From the outer head of the radius, paſſing over the knee through an annular ligament, into the upper and back part of the bone down to the foot.	To aſſiſt the former.
Perforated flexor of the foot.	From the inner condyle of the ſhoulder-bone paſſing behind the knee, into the arch of the coffin-bone.	To bend the foot.
Perforating flexor of the foot.	From the olecranon and the ſhoulder-bone at the back part, into the arch of the coffin-bone.	To aſſiſt the former.

2. *Muſcles of the Hind Leg or Foot.*

Name, &c.	*Origin and Inſertion.*	*Uſe.*
Poſterior gluteus. *m*, *n*, *o*, *p*, fig. 9.	From the interior and poſterior angles of the ilium, into the little trochanter of the thigh-bone.	To extend the thigh, and draw it outwards.
Tenſor vaginæ femoris. *Faſcia lata.* *a*, *b*, *c*, *c*, D, *e*, *f*, *g*, *h*, fig. 9.	From the anterior angle of the ilium, into a tendinous expanſion over the thigh.	To ſtretch the faſcia of the thigh, and draw it inwards.
Semimembranoſus. 17, 18, 19. fig. 9.	From the tuberoſity and lower angle of the iſchium, into the fore part of the thigh-bone, and into the tibia.	To draw the thigh outwards.
Biceps flexor cruris. 3, 4, 5—11, fig. 9.	From the tuberoſity of the iſchium, and beginning of the tail, into the inner ſide of the ſpine of the tibia.	To bend the leg, and draw it inwards.
Poſterior flexor of the leg.	Like the former, into the inner condyle of the thigh-bone and upper end of the tibia.	To bend the leg.
The large gluteus. *q*, Q, *r*, *s*, *t*, fig. 9.	From the vertebræ of the loins, and from the ſacrum, into the great trochanter of the thigh-bone.	To extend the thigh, and draw it backwards and outwards.
Capſular. *a*, *b*, *c*, fig. 12.	Riſes from the brim of the acetabulum, into the outer ſide of the thigh-bone.	To extricate the capſular ligament.
Gracilis. *e*, *f*, fig. 9. *u*, *w*, fig. 11.	From the pubis and iſchium, into the faſcia of the thigh and the inner ſide of the head of the tibia.	To make one thigh approach its fellow.
Sartorius. *Adductor longus.* *p*, *q*, *r*, *s*, *t*, fig. 11. *t*, *u*, fig. 12.	From the inner edge of the brim of the pelvis, into the inner head of the tibia.	To aſſiſt the former.
Large pſoas.	From the three laſt dorſal, and four firſt lumbar vertebræ, and from the two laſt falſe ribs, into the inner trochanter of the thigh-bone.	To bend the thigh.
Larger internal iliac. *e*, fig. 10.	From the inner ſurface of the ilium, into the leſſer trochanter of the thigh-bone.	To aſſiſt the former.
Leſſer internal iliac.	From the inner ſurface of the ilium, into the leſſer trochanter of the thigh-bone.	To aſſiſt the former.
Pectineus. *s*, fig. 12.	From the ſymphyſis pubis, inſerted below the laſt.	To bend the thigh.
Triceps adductor femoris.	From the inner edge of the pubis, from the anterior branch of the iſchium, and from its tuberoſity, into the back of the thigh-bone, the upper and inner part of the tibia, and the tuberoſity of the thigh-bone.	To draw one thigh towards its fellow.
Vaſtus externus. *n*, *o*, *p*, *r*, *s*, *t*, fig. 10.	From the great trochanter, and the outer ſide of the thigh-bone, into the ſide of the knee-pan.	To extend the leg.
Straight muſcle of the leg. *Rutus cruris.* *g*, *h*, *i*, *k*. fig. 10.	From the ilium above the ſocket, and from the upper part of the thigh-bone, into the upper part of the knee-pan.	To extend the leg ſtrongly.
Vaſtus internus. *b*, *c*, fig. 10.	From the neck, inner tuberoſity, and whole inner part of the thigh-bone, into the inner ſide of the knee-pan.	To aſſiſt the vaſtus externus and laſt muſcle.
Crural. 1, 2, 3, 4, 5, 6, fig. 11.	From the fore part of the thigh-bone, into the inner ſide of the knee-pan.	Ditto.
External obturator.	From the inner part of the iſchium, into the hollow of the great trochanter.	To roll the thigh-bone.
Square muſcle of the thigh. *Quadratus femoris.*	From the lower part of the tuberoſity of the iſchium, into the thigh-bone below the great trochanter.	Aſſiſts the former.
Gemini. *f*, *g*, fig. 10.	From the iſchium and pubis, one above the other, inſerted into the thigh with the laſt.	Oppoſe the laſt.

Inner

Name, &c.	*Origin and Inſertion.*	*Uſe.*
Inner obturator. 1, 2, 3, fig. 12.	From the edge of the thyroid hole, into the thigh with the preceding.	To aſſiſt the gemini.
Pyriform.	From the ſacrum within the pelvis, inſerted as the laſt.	Ditto.
Popliteus. 28, 29, fig. 11.	From the external condyle of the thigh-bone, into the tibia.	To draw the leg inwards.
Tibialis anticus. 14.	From the fore part of the external condyle of the thigh-bone, into both canons by two portions.	To bend the leg ſtrongly.
Gaſtrocnemius.	From each condyle of the thigh-bone, into the hock.	To extend the canon.
Plantar. 40, fig. 9.	From the upper part of the ſpine of the tibia, inſerted as the former.	
Perforated flexor of the foot.	From the hollow between the condyles of the thigh-bone, into each ſide of the paſtern-bone.	To bend the paſtern and foot.
Larger perforating flexor of the foot.	From the back and outer part of the head of the tibia, into the arch of the coffin-bone.	To bend the foot.
Leſſer perforating flexor of the foot.	From the back part of the head of the tibia, inſerted with the preceding.	To aſſiſt the former.
The long extenſor of the foot.	From the tendon of the extenſor of the canon, in the anterior protuberance of the coffin-bone.	To extend the foot.
Lateral extenſor of the foot.	From the outer head of the thigh-bone, and from the head of the fibula, inſerted with the laſt.	Ditto.
Leſſer extenſor.	From the tendon of the long extenſor to the lateral extenſor.	To draw the tendons of the long and lateral extenſors together.

The four figures to which we have referred alſo repreſent the following parts.

The broad ligaments of the eyelids; *s*, *t*, fig. 9.
Alæ narium; *x*, fig. 9.
Angular vein; 14, fig. 9.
Angular artery; 15, fig. 9.
Parotid gland; 26, fig. 9.

In the Neck.

Common jugular vein; 1, fig. 9.
External anterior jugular; 2, fig. 9.
Poſterior external jugular; 3, fig. 9.
Part of the carotid artery; 4, fig. 9.
Branches of the cervical arteries and veins; 1, 2, fig. 10.
Thyroid gland; *a*, fig. 11.
Gullet; *i*, fig. 11.
Windpipe; *k*, fig. 11.
Cervical nerves; 2, fig. 11.
Ligament of the neck; 5, fig. 11.; 7, 8, fig. 12.
External carotid artery; 1, fig. 12.

In the Trunk.

Epigaſtric artery; *w*, fig. 11.
External iliac; *y*, fig. 11.
The diaphragm; *m m*, fig. 12.
Intercoſtal artery; *p*, fig. 12.

In the Fore Extremity.

Internal plantar vein; *s*, fig. 9.
Coronary ligament of the foot; 13, fig. 9.
Cartilages of the coffin-bone; *r*, *t*, 11.

In the Hind Extremity.

Vena ſaphæna; 21, fig. 9.
Capſular ligament of the knee; 3, 4, fig. 10.
Sciatic artery; 34, fig. 11.
Gluteal artery; 35, 35, fig. 11.
Crural vein; 38, fig. 11.
Popliteal artery; 39, 52, fig. 11.
——— vein; 53, fig. 11.
Crural nerve; 35, fig. 12.

Chap. III. *Of the Stomach and Bowels.*

104 Structure of the ſtomach.

In the horſe there is but one ſtomach, which is very ſmall in proportion to his general bulk; and is partly membranous, partly cuticular, and partly muſcular. It is ſituated immediately behind the diaphragm, in the left hypochondrium, and in part of the epigaſtrium, with its expellent orifice extending acroſs the ſpine to the right, which is the reaſon that lying on that ſide is judged more wholeſome than ſleeping on the left. It has two ſurfaces, which may be called its ſides, though one is poſterior, and the other anterior; and two extremities, a large and a ſmall; the ſuperior ſurface of which receives the gullet, and is called its *cardiac orifice;* while the former ends in the duodenum, and is termed the *pyloric orifice;* this extremity, when the ſtomach is diſtended, is the moſt poſterior of the two: The hollow part ſituated ſuperiorly, only forms its *leſſer curvature*, as the lower portion forms its *great curvature*.

Thus when the ſtomach is moderately diſtended, it lies in an obliquely tranſverſe direction, with its great extremity a little forwards, and its two orifices ſuperi-

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or, but the *cardiac* the moſt ſo, with the leſſer extremity rather poſterior to the other, and the great curvature inferior. It is evident that the ſituation of the ſtomach muſt vary much with its diſtenſion: the foregoing deſcription anſwers to it when moderately diſtended only; but where it is very much filled, the left extremity will preſs upon the diaphragm, and the right will be carried more poſteriorly. In oxen and ſheep, where the firſt ſtomach is large, it is found, when diſtended, to have its left extremity carried quite into the left iliac region; in which part it is uſually punctured, when they are hoved: but ſuch an idea of the ſtomach of the horſe would prove very erroneous; for this animal has a very ſmall one, and therefore its ſituation can never be ſuch *.

* *Blaine's Outlines*, vol. ii.

From a diſtended ſtomach preſſing upon the diaphragm, we are at no loſs to underſtand, why breathing is impeded after a full meal, when a horſe appears to labour for breath; for he is forced to uſe the intercoſtal muſcles, and the muſcles of the ſhoulder and fore extremities, to open the cheſt, the poſterior enlargement being prevented from the diaphragm being fixed by the preſſure of the ſtomach; hence we ſee the great impropriety of galloping horſes after watering, to warm it in their bellies, as it is fooliſhly termed. Horſes, when grazing, if they drink, are never obſerved to do this; if it was neceſſary, nature would dictate it to them. How hurtful it is likewiſe to ride hard, after a horſe has been full fed, is equally evinced. The ſtomach has externally a covering from the peritoneum, which adheres cloſely to it, by means of its cellular portion; and which portion is dipping in between the muſcular fibres. Its middle portion is made up of muſcular fibres, which are more numerous in this animal, than in the ruminant; making this kind of ſtomach a medium between the membranous one of ſome animals, and the true muſcular ſtomach of others. The direction of theſe fibres is various; but they may principally be referred to a longitudinal and a tranſverſe order, though neither of them are regularly ſo, and are intermixed with others, whoſe direction is very oblique, and interlaced with each other. The longitudinal plane is the moſt external of the two, and appears a continuation of the external plane of the œſophagus, with ſome original fibres, which ſpread over the leſſer curvature, being carried obliquely round, and likewiſe over the great extremity, forming themſelves into a kind of vertex, whoſe centre is in the middle of that extremity. The inner plane is by much the larger, and is not quite circular, but ſlightly oblique, croſſing the obliquity of the longitudinal plane. This circular plane is very thick and ſtrong round the cardia, or that extremity into which the œſophagus terminates. They are here ſo very thick as to form a true ſphincter; and to this it is in ſome meaſure owing, that a horſe cannot vomit; for when the circular and longitudinal fibres are acting from the pylorus to the cardia, by any irritation that reverſes the uſual motion, producing an effort to vomit, the circular and longitudinal fibres of the cardia being infinitely ſtronger and more numerous, are contracting this orifice (eſpecially the circular), as the others are contracting the other parts; for as the muſcular fibres exiſt equally throughout the ſtomach, by which the motions are effected, it cannot be ſimply from the exiſtence of the circular covering to

105 Reaſons for the horſe's not vomiting.

the firſt portion of his ſtomach, that he cannot vomit; for it is reaſonable to ſuppoſe the fibres act throughout the ſtomach by the common conſent of parts; nor do they of actual neceſſity want an immediate ſtimulus to their ſurfaces; for were this the caſe, the fibres of the œſophagus would not by the preſence of the maſticated bolus be ſtimulated to contract through the cuticular coat, which equally here lies over the fibres; nevertheleſs, the cuticular coat of the ſtomach is probably aſſiſting in this difficulty to regurgitate: it does it by leſſening the liability to nauſea, which ſeldom takes place in the horſe; and as vomiting is only an effort to remove nauſea or its cauſe, ſo nature not having given the diſeaſe, has not provided the means for its removal. As likewiſe vomiting appears to be a reverſing of the periſtaltic motion of the ſtomach; which motion, in its natural ſtate, begins from the cardia, and ends at the pylorus; ſo in this reverſed ſtate, it commences at the pylorus, and ends at the cardia, thus regurgitating its contents; ſo it is very probable that the cuticular covering may leſſen this inverted periſtaltic motion in the upper portion, though it cannot wholly deſtroy it; and hence cannot be the only, or the principal reaſon of the impoſſibility, or rather of the difficulty with which this animal vomits; for inſtances have occurred where it has taken place. A horſe in Suſſex was ſeen to regurgitate a large quantity of grains, and we have heard of one or two other inſtances; but theſe muſt be regarded as very rare occurrences.

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It is not, therefore, that the ſtomach of the horſe cannot be irritated to make an attempt to vomit, that no ſuch effect generally takes place; for though it is but very ſeldom that nauſea occurs, and perhaps never in a ſtate of nature, yet it may be excited by means of aconite, hellebore, and ſome other ſubſtances, which have cauſed fruitleſs efforts to vomit. But the true and principal reaſon that a horſe may be ſaid, naturally not to be able to vomit, ariſes, in that nature has wiſely ſo conſtructed the parts, that the very effort to it increaſes the reſiſtance by the very ſtrong ſphincter placed at the mouth of the cardia. Had this reſiſtance not been placed, and every means taken to increaſe the almoſt impoſſibility of vomiting in a horſe, it is evident that from the curtain of the palate ſtopping the opening of the mouth, this action, had it taken place, would have occaſioned ſuffocation. The inner coat of the 106
ſtomach is compoſed of two portions, the one cuticular and the other villous. This ſpecies of cuticular covering to nearly one half of the ſtomach, is peculiar to ſuch animals as appear deſtined to live on grain, as horſes, aſſes, rats, and mice; and this forms a third ſpecies of ſtomach between the true membranous one of graminivorous animals, and the muſcular of the carnivorous tribes, and it may be conſidered in a ſlight degree, as a ſpecies of gizzard, reſembling the ſtructure of thoſe animals, as fowls, who have organs to make up for the want of teeth. For a horſe has not the means of re-maſtication, as in oxen or ſheep, nor does he uſually maſticate his food at firſt ſufficiently to comminute it; for the wants of the conſtitution ſtimulate him to a haſty deglutition of his food, which, if there was not ſome other ſtructure than that common to ſtomachs in general, would not be ſufficiently digeſted: for the food is ſolid, and the ſtomach ſmall; therefore this cuticular coat may be uſeful, as its inſenſibility allows it to preſs in

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in a ſmall degree upon the food, and perform a ſlight trituration upon it. This cuticular coat is ſpread over the firſt portion of the ſtomach, taking in all the great extremity, and forming between a third and half of its extent. It is formed into folds at the cardia in the ſame manner as at the internal part of the œſophagus; but as ſoon as it has paſſed this orifice, theſe folds take an irregular direction, but are leſs than thoſe formed on the villous ſurface.

The villous or ſenſible portion of the ſtomach, though it occupies more of the length of the ſtomach, yet perhaps in real extent is little more than half of its ſurface. It unites with or is connected to the cuticular. Its external ſurface is firm, and appears as it were a diſtinct portion, but is only denſe cellular ſubſtance, which has given riſe to the deſcription of four tunics to the ſtomach. The *tunica villoſa* is ſo called from its reſemblance to the pile of velvet; its fine villi are probably the extreme fine ends of veſſels ſecreting the gaſtric juice. The villous coat being much larger in extent than the muſcular, is thrown into folds, which are more conſiderable than thoſe of the cuticular coat. Theſe are largeſt at the portion toward the great extremity, and are irregularly waving: towards the duodenum they become leſs, and when at the pylorus they form a fold that makes a kind of valve to this part of the ſtomach, preventing the return of the food, and its too ſpeedy paſſage out. The folds not only hinder the too ſpeedy paſſage of the food, but by this means apply the gaſtric juice more certainly to all the parts; but the principal end is to increaſe the ſecreting ſurface, which is here more extenſive than thoſe of the human *.

* *Blaine's Outlines.*

127 Bowels.

The remainder of the alimentary canal is continued from the lower orifice of the ſtomach, to the anus, or end of the paſſage, forming a long canal of different dimenſions, called *inteſtines*. They are uſually divided into ſmall and large. In ſome animals they hardly merit this diſtinction, there being but little difference in point of ſize: but in the horſe, the proportion is very different; the ſmall inteſtines being not much larger than the human, but the large of an immenſe bulk. This canal is connected through its whole extent to membranous productions of the peritoneum, eſpecially to thoſe called *meſentery* and *meſocolon*. The whole canal varies in point of length in different ſubjects; but is ſeldom leſs than 24 yards, and often more. The inteſtines are contained within a prolongation of the peritoneum, which ariſes in moſt inſtances from the meſentery: the two folds of this membrane ſeparate and ſurround the inteſtines, forming their external coat. The next coat is muſcular, and formed of two layers of fibres, a longitudinal and a circular; the latter are in greater proportion, and by the contraction of theſe the vermicular motion, called *periſtaltic*, is performed, from the longitudinal fibres ſlightly ſhortening them, and the circular diminiſhing their ſize. Within this muſcular coat there is a quantity of cellular membrane rather more denſe than in ſome other parts; and this uſed to be regarded as a coat, and was called the nervous, but is only a layer of cellular membrane. The third and inner coat of the inteſtines is the villous, which is very vaſcular and ſenſible. There are no conſiderable folds of the inner tunic of the inteſtines, as in the human. In this animal theſe are rendered unneceſſary by the great length of his inteſtines, and the ſlow paſſage of the aliments through them by this length and his poſition.

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The firſt portion of the bowels, which anſwers to the *duodenum* in man, though in the horſe it is nearer 20 inches than 12, is attached to the ſtomach, having its pyloric orifice ending in it; its courſe in the horſe is rather different from that in the human, and by this it acquires a more complete covering from the peritoneum. It hangs looſe and pendulous, being attached to the concave ſurface of the liver, where making a turn, it is fixed to the vertebræ: it then takes the name of *jejunum*. It appears rather larger in circumference than the other ſmall inteſtines, and is remarkable for having the pancreatic and biliary ducts penetrating it, ſometimes entering it obliquely cloſe together, and ſometimes at a diſtance from each other.

108 Firſt portion.

109

The *jejunum* and *ilium* differ very little from the ſame bowels in the human ſpecies.

Jejunum.

110

The great inteſtines are very properly ſo called in the horſe; and as they have very little reſemblance to the human large inteſtines, they require a particular deſcription.

Large inteſtines.

111

The *cæcum* is ſituated in the back part of the belly, and is a very large canal, which is entered abruptly by the ilium. The fore part of this canal projects forward two or three feet, into a ſort of bag of the ſame ſize of the colon; but the back part terminates in what is called a blind end. The cæcum uſually occupies the right ſide of the belly, and appears immediately on opening the peritoneum, with its commencement from the colon and ilium in the right iliac region, extending forwards to the right ſide, with its blind end cloſe to the diaphragm and liver. This termination is not furniſhed, as in ſome animals, with an appendix vermiformis, but terminates by a ſimple blind end. Through the peritoneal covering are ſeen four muſcular longitudinal bands, extending from the extremity along the muſcular coat, and dividing the gut into four longitudinal portions. One or two of theſe are uſually covered with fat, and are not ſo regularly longitudinal as the others. The internal membrane is folded up between the longitudinal bands, and by interſecting them forms numerous cavities called the cells.

Cæcum.

On the ſlighteſt inſpection we ſee a great peculiarity in the form of the cæcum of the horſe; and in a more accurate view, are ſtruck with the importance of the ſtructure to this animal, and are led to conſider the cæcum as little leſs than a ſecond ſtomach. This is in fact the caſe; for the food coming in a macerated maſs from the ſmall inteſtines, is mixed in the cæcum, with the bile, and pancreatic juice, and here undergoes a farther change, to which the ſtructure of the cæcum is evidently favourable, as it is fitted to retain the maſs for a conſiderable time within it, and to circulate it through all its parts. It has two blind ends, one forming its baſis, and near this enters the ilium; the other forming its point, and extending up towards the diaphragm. From one part of the baſe the colon commences by a very contracted portion, for the purpoſe of preventing the entrance of the contents of the ilium, till they have paſſed through the cæcum. In many animals the cæcum is a very inconſiderable part; in ſome it has one or more appendicles; in others it is almoſt entirely wanting; and

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and in all but the horſe its uſe is obſcure, and apparently not very important; but in the horſe it is certainly little leſs than a ſecond ſtomach, for its whole ſtructure proves, that it is purpoſely deſigned that all the food taken in ſhall be poured into the baſe of this gut, by the contraction of which it ſhall be forced towards the apex, and either in its paſſage or return ſhall be detained in the cells to be in ſome way farther acted upon, and to undergo ſome change neceſſary to the ſyſtem. Having undergone this change, whatever it is, it is forced into the colon.

112 Colon.

The colon commences ſmall from the ſide of the baſe of the cæcum; and as the ilium cannot be ſaid to enter it together with the cæcum, as in ſome animals, there is in the horſe no ſuch part as the valve of the colon properly ſo called. The ilium has, however, a ſort of protruſion with its inner membrane, by which in ſome meaſure it prevents the return of the contents of the cæcum. As the colon paſſes, it is farther contracted, and then enlarges into a very long and large canal, which, after having made nearly the whole circumference of the belly, is again ſlightly contracted. It then again enlarges, paſſes again round the belly, and is a third time contracted, juſt where it ends in the rectum or ſtraight gut. The ſmall inteſtines reſt on the turns of the colon and on the cæcum. The colon is furniſhed with four ligamentous bands in its large portion, but there are only two in the ſmall portions; theſe form longitudinal fræna, which are interſected again by internal folds, ſo as to form the cells of the colon. It is connected and ſupported in its ſituation by that portion of the meſentery termed *meſocolon*. This inteſtine is very different in the horſe to what it is in moſt other animals, in conſequence of its variations in ſize, being in moſt other inſtances of one general ſize; it is likewiſe this gut and the cæcum that are the principal ſeat of the inflammation ariſing from violent purging medicines.

113 Rectum.

The *rectum* is the continuation of the colon, and paſſes backwards from the lumbar vertebræ to the anus. Its muſcular coat is thicker than that of the other inteſtines, and it is thrown internally into cavities by the inner membrane, in ſome manner ſimilar to the cells of the colon, though leſs; were it not for this, the inteſtine might be too conſtantly ſtimulated to expel its contents, but by this means the fæces are received and retained till they are collected in a conſiderable quantity, when they are expelled. The rectum is attached to the ſpine and ſacrum by the peritoneum, is here called meſorectum; but the true fold of peritoneum does not inveſt its whole portion, but leaves it as it approaches the rectum, which is at this place only covered with the cellular part of it. The meſentery bands of the rectum are very ſtrong, and terminate at the anus in a kind of ligamentary expanſion attached to the *os coccygis*.

The *anus* is the termination of the rectum, and is opened by the force of the periſtaltic motion and the conſent of the parts, and ſhut by a muſcular band round the extremity of the gut called the *ſphincter*. It is likewiſe elevated and retracted by two pair of muſcles.

Chap. IV. *Of the Foot.*

In our account of the anatomy of the horſe's foot, it will be neceſſary to deſcribe only one foot, as thoſe belonging to both extremities are ſimilar in ſtructure.

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The bones which compoſe the foot of the horſe are ſix in number, conſidering the foot as commencing at the fetlock joint. Of theſe ſix bones two are included within the hoof, viz. the coffin-bone, and the navicular-bone; and four are ſituated above the hoof, viz. the large paſtern-bone, the ſmall paſtern-bone, and the two ſeſamoid bones.

114 Bones.

We ſhall begin from above, with the large paſtern-bone, as this contributes to form what is called the large paſtern joint.

115 Large paſtern bone.

The large paſtern-bone, (1, fig. 13, 14, and 15.) is of an oblong cylindrical form, and, as is the caſe with all ſuch bones, is ſmaller in the middle than at either extremity. It articulates above with the lower head of the canon-bone, and below with the upper head of the ſmall paſtern-bone. At its upper extremity there are three depreſſions, one on each ſide, large and ſuperficial (*a*, *c*, fig. 13.) to receive the outer and inner convexity of the lower head of the canon-bone, and one in the middle, *b*, for receiving the middle narrow convexity of the ſame bone. The fore part of this bone is ſlightly rounded, and rough towards its upper extremity, as at *d d*, for the firmer attachment of ligaments. Behind, at its back part, it is flatter; and here there is a rough depreſſion (C, fig. 14.) alſo for the attachment of a ligament that is deep ſeated, and is fixed to the two ſeſamoid bones. At the lower extremity the large paſtern-bone is convex on each ſide (D, E, fig. 14.) for entering into two concavities of the ſmall paſtern-bone; and there is a depreſſion (*f*, fig. 13.) for the attachment of a tendon. At the lower extremity there is alſo a roughneſs on each ſide at *e e*, for the inſertion of ligaments. Both extremities are covered with very ſmooth elaſtic griſtle, which is kept conſtantly moiſt by the ſynovia or joint oil.

116 Seſamoid bones.

At the upper end of the large paſtern-bone, towards the back part, are placed the two ſeſamoid bones, A A (fig. 14.). Theſe are of an irregular wedge-like form, and are covered with cartilage, articulating both with the canon-bone, and on the back part they are very ſmooth to admit of a tendon readily ſliding over them. The upper edges of theſe bones on each ſide have a rough irregular ſurface, into which is inſerted a ſtrong ligament that comes from the upper and back parts of the canon-bone, is faſtened ſeparately to each of the ſeſamoid bones, from which it proceeds downwards and obliquely forward to be inſerted into the tendon of the large extenſor muſcles, (ſee *a a a*, fig. 16.) a little below the large paſtern-joint. Theſe ſeſamoid bones are of conſiderable uſe in the mechaniſm of the large paſtern-joint. "In conſequence of their forming the back part of the large paſtern-joint, and articulating with the lower and poſterior part of the canon, they contribute very eſſentially, by always receding whenever the foot comes in contact with the ground, to act as a ſpring to the animal, and to prevent concuſſion. All the weight received by the upper head of the large paſtern-bone is conveyed to bones below; but a conſiderable portion of the burthen is received by the ſeſamoid bones. While the animal is at reſt, and alſo during motion, theſe bones ſuſtain part of the weight; and where the paſtern bones are long and oblique, the ſeſamoids often receive ſo much of the weight as to put the ligaments violently on the ſtretch, and occaſion lameneſs *." * *Coleman on the Horſe's Foot*, vol. ii.

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117 Small paſtern bone.

The ſmall paſtern-bone (2, fig. 13, 14, 15.) is about half the length of the large one, and is as broad as it is long. Beſides the two concave depreſſions, (*h*, *h*, fig. 13.) mentioned before, there is a ridge between them, *i*, that enters a correſpondent depreſſion, *g*, in the lower head of the large paſtern-bone. The ſmall paſtern-bone has at the back and upper part (F, fig. 14.) a ſmall projection, for the inſertion of a long ligament, that comes from the ſeſamoid bones. The lower articulating ſurface is more extenſive than the upper, as it is connected with the upper ſurface of two conſiderable bones, viz. the navicular and coffin-bone. It is of great conſequence to underſtand the mechaniſm of the joints that are formed by this connection, as it is on this part that the principal ſtreſs of the animal falls. The union of the ſmall paſtern-bone with the navicular and coffin-bones, forming what is called the *coffin-joint*, is one of the principal methods provided by nature to prevent concuſſion.

118 Navicular bone.

The navicular-bone (3, fig. 13, 14, 15.) is connected above with the back part of the ſmall paſtern-bone, and the lower edge of this bone is attached by a large ligament to the back part of the coffin-bone. The navicular-bone is ſlightly concave, to receive the back part of the lower head of the ſmall paſtern-bone. The upper edge of the navicular-bone behind is rough (*g*, fig. 14.) and thick, for the attachment of the upper ligament; and the lower edge of the navicular-bone receives at the back part a ſtrong flat ligament from the coffin-bone, immediately above the inſertion of the flexor-tendon. The lower ſurface of the navicular-bone is covered by cartilage, and has a ſmall ridge in its centre, (*l*, fig. 13.) to be received into a correſponding depreſſion in the long flexor-tendon. This bone may be conſidered as forming two diſtinct joints, one of which is compoſed by the connection of one part of the bone with the tendon of the flexor-muſcle, and the other is formed by the connection of another ſurface of the navicular-bone.

The whole weight of the animal, ſupported by the ſmall paſtern-bone, is thrown upon the coffin and navicular bones. Of this weight the coffin-bone receives the greater ſhare; but the navicular-bone receives a conſiderable portion of it, though this bone does not contribute to prevent concuſſion ſo much as Mr Freeman has endeavoured to prove. The navicular-bone, when the hoof touches the ground, deſcends a little, and thus prevents that concuſſion which the horſe's body would have received if this bone had been immoveably fixed; and when the hoof is again raiſed from the ground, the elaſticity of the parts below the navicular bone lifts up this bone into its former poſition, thus acting as a ſpring in facilitating the motion of the animal. As the weight ſupported by the navicular-bones of the hind feet is leſs than that ſupported by the ſame bone of the fore feet, their deſcent in the former is leſs than in the latter. The organs connected with the navicular-bones of the hind feet are alſo leſs ſubject to diſeaſe.

119 Coffin-bone.

The coffin-bone (4, fig. 13, 14, 15.) is ſo named from its being concealed, or as it were buried within the hoof. It is alſo ſometimes called the foot-bone. On its fore part it is rounded, having very nearly the ſhape of the external hoof. Its upper ſurface is ſlightly hollowed (*m*, *m*, fig. 13.) to receive the lower end of the ſmall paſtern-bone, with the fore part of which it articulates, as it does behind with the fore edge of the navicular-bone. At the back part the coffin-bone ends in two proceſſes on each ſide, the upper of which are tipped with cartilage. At the upper part of the front of the coffin-bone there is a ſmall protuberance, (*w*, fig. 13.) extending upwards above the joint, and ſerving for the inſertion of the tendon of the muſcles that extend the foot. Below this the coffin-bone is extremely porous, for the paſſage of nerves and blood-veſſels; and towards the lower part in particular there are about 13 holes, for the tranſmiſſion of conſiderable arteries, which go to ſupply the ſenſible ſole. At the heels and quarters the coffin-bone is ſtill more porous, and is ſupplied with a greater number of arteries, but theſe are proportionally ſmaller. The lower ſurface of the heels of this bone is alſo very porous, where it unites with the ſenſible ſole, but the reſt of lower ſurface is generally ſmooth. There are here two hollow ſurfaces, which receive two correſponding rounded parts of the ſenſible ſole. They are unequal, the foremoſt being the larger. Into the hollow on the back part, the tendon of the flexor-muſcle is inſerted. (A, fig. 16.)

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120 Ligaments.

There are ſeven ligaments belonging to the coffin joint, of which there are three pairs, and one ſingle. The firſt pair of ligaments take their origin from the heels of the coffin-bone on each ſide, and paſs obliquely upwards as high as the middle, to which they are attached, and at which part of the ſmall paſtern-bone (B, fig. 16.) they are blended with the fibres of the lateral ligaments of the ſmall paſtern-joint. The ſecond pair of ligaments on each ſide ariſe from the edge of the coffin-bone, near the heels, and paſs obliquely forward to be inſerted into the middle of the ſmall paſtern-bone (C, fig. 16.) near the attachment of the extenſor-tendon. The third pair take their origin from the lateral edges of the anterior proceſs of the coffin-bone, and are inſerted into the edges of the cartilages. The uſe of theſe ligaments is to unite the cartilages more firmly to the coffin-bone. The extenſor-tendon being inſerted into the upper edge of the anterior proceſs of the coffin-bone, prevents the neceſſity of a ligament at this part. The ſingle ligament of the coffin-bone is connected with the poſterior and inferior concave ſurface of the coffin-bone, immediately above the inſertion of the flexor-tendon, and alſo with the lower edge of the navicular bone. Beſides this ligament there is another attached to the whole of the upper and back part of the navicular-bone, by which means that bone is enabled to ſupport a greater ſhare of the weight that reſts upon it. By means of theſe ligaments this important joint is rendered very ſtrong, while by the elaſticity of the cartilages, and the conſtant ſupply of lubricating fluid within the joint, all the motions of the animal are rendered ſafe and eaſy.

The ſmall paſtern-joint is alſo well ſecured by means of ligaments, and by the ſheath of the flexor-tendon. There are alſo ligaments proceeding from the ſeſamoid bones, which enter the ſheath of the flexor-tendon, and are attached to the ſmall paſtern-joint. (*a*, *a*, *a*, fig. 16.)

"The weight which the ſeſamoid bones, by means of ligaments ſuſtain, is very different in different horſes; and bears no proportion to the bulk and weight of the animal. The paſtern joints of large horſes deſtined for ſlow motion, are conſtructed very differently from thoſe of

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of blood horſes. Their paſtern bones are ſhort, and the joints nearly ſtraight; but thorough-bred horſes of light weight have long and very oblique paſtern joints; and, as in proportion to the obliquity of the large paſtern, or fetlock joint, the canon conveys more of the weight to the ſeſamoid bones, the ligaments that ſupport the ſeſamoids are neceſſarily put into motion, and more on the ſtretch, as the weight preſſes down the lower and back part of the canon on the ſeſamoid bones. Short paſtern joints are as much adapted to the frame of heavy horſes as longer joints are to that of lighter horſes. The ligaments that ſupport the ſeſamoids above alſo contribute to aſſiſt the flexor muſcles and tendons in preſerving when at reſt, and in motion, the large paſtern-joint in its proper place." *

* *Coleman on the Horſe's Foot*, vol. ii.

Before we proceed in deſcribing the ſtructure of the foot, it will be proper to ſhew how the hoof is formed, and how it is connected with the parts within.

121 Structure of the hoof.

The hoof of the horſe forms a ſort of organized ſhoe, which is adapted to the foot with the greateſt nicety; ſo that every part of the cavity is completely filled, without the foot's being ſubjected to any unequal preſſure.

A correct knowledge of the natural form and ſtructure of this part of the horſe's foot, and of the deformities produced in it by improper treatment, is of the utmoſt importance; as on this muſt depend the moſt advantageous method of ſhoeing, and the only rational means of correcting the unnatural deviations. It will be obvious, that, in order to form a juſt idea of the original ſhape of the hoof, we muſt examine it before any ſhoe has been applied to it; for, unleſs this ſhoe has been ſo conſtructed and fitted to the foot, as to preſerve unaltered the original form of the hoof, this will be ſo changed, that we cannot recognize from it what was the original ſhape. That the methods of ſhoeing uſually employed are calculated rather to deform the hoof, than to preſerve its original figure, will appear preſently.

A vertical ſection of the hoof ſhows it to be nearly conical; the broadeſt part of the cone being next the ground. This inferior ſurface, in a hoof that has not been ſhod, eſpecially in the fore foot, appears nearly circular; or the diameter, from ſide to ſide, is nearly equal to the diameter from toe to heel, (ſee fig. 17.)

The hoof is compoſed of a horny ſubſtance that is entirely without ſenſation. It is divided into cruſt, ſole, frog, and bars.

122 Cruſt.

The cruſt ſurrounds the foot on the fore part, and on the ſides, like a wall (A, A, fig. 17.) It grows obliquely downwards from the coronet, and becomes broader as it approaches the ground. It is thicker at the toe, than at the quarter; and the outer quarter is thicker than the inner. On the outſide it is ſmooth and rounded, but within hollow and laminated (B B, fig. 15.) to unite with the coffin-bone. The cruſt is the only part into which nails can with ſafety be driven in ſhoeing.

123 Horny ſole.

The horny ſole (B B, fig. 17.) unites with the lower part of the cruſt, and is ſituated below the coffin-bone; but between it and the coffin-bone, there is a vaſcular ſubſtance to be preſently deſcribed, called the *ſenſible ſole*, from the blood-veſſels of which the horny ſole is formed. On the outſide next the ground, the horny ſole is hollow, but rounded within next the coffin-bone. The horny ſole protects the ſenſible ſole from injury, and in the horſe's motions it embraces the ground, acting as a ſtop. When the laminated ſubſtances of the hoof lengthen, the horny ſole deſcends, and thus aſſiſts in preventing concuſſion.

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124 Bars.

The bars, or binders, (C C, fig. 17.) are two horny ſubſtances placed between the ſole and the frog, and forming at the heels a cloſe ſolid union with the cruſt. The ſmall part of the bars called the *toe*, ſometimes reaches almoſt as far as the toe of the frog. Within the frog, the bars are laminated like the inner part of the cruſt, and are cloſely united to the horny ſole. The bars on the outſide keep the horſe's foot extended, and within, they tend to prevent the ſeparation of the ſenſible ſole from the horny ſole. In the natural ſtate of the hoof, there is a conſiderable cavity between the bars and the frog on each ſide.

125 Frog.

The frog (D D, fig. 17.) is that hard rounded protuberance, which we obſerve in the middle of the lower part of the hoof, pointed towards the toes, and expanded towards the heel like a wedge. In the middle of this broad part, there is a fiſſure (E, fig. 17.) The external frog is united within the hoof to a narrow ſubſtance of a ſimilar ſhape, but of a more elaſtic ſtructure, and poſſeſſing ſenſation, and therefore called the ſenſible frog. This ſubſtance is connected above with the navicular bone, towards the back part; and at the extremity of the heels, it is united with cartilages on each ſide. The toe of the ſenſible frog is united to the coffin-bone, but by far the greater part is behind this bone. The back part of the frogs being united with elaſtic and moveable ſubſtances, admit of conſiderable motion, the frog riſing when the hoof touches the ground, and deſcending when the foot is raiſed. By the aſcent of the frog, the heels are prevented from contracting, and the cartilages are expanded, ſo as to afford the horſe a conſiderable ſpring, whilſt the form of this part fits it for embracing the ground, and thus prevents the horſe from ſlipping. The convex form of the frog clearly ſhews that it was always intended to touch the ground, and experience has fully proved, that, unleſs this contact takes place, the healthy ſtate of this organ cannot be preſerved. It has been ſuppoſed that the frog is intended to defend the principal tendon or back ſinew; but Mr Coleman has ſhown that this is a miſtake.

126 Weight of the horſe not ſupported by the ſole and frog.

The weight of the horſe is chiefly ſupported by the cruſt, and not by the ſole or frog; for when theſe parts have been removed, or by being diſeaſed, become ſoft and fungous, and thus incapable of reſiſtance, it is found that the cruſt is ſtill competent to bear the whole of the weight. If the ſole and frog really ſupported the weight, it is evident that when theſe parts are removed or diſeaſed, the foot would ſlip through the cruſt.

127 Importance of the frog's receiving preſſu-

The union of the ſenſible frog with the horny frog, and the connection thus formed between the ſides of the ſenſible frog and the lower cartilages, effectually prevents diſlocation. When the horny frog touches the ground, both that and the ſenſible frog aſcend; but when by any means the horny frog is prevented from preſſing on the ground, its proper functions are ſuſpended. The cartilages partake of the motion of the frog; and, in proportion as this receives preſſure, they recede from each other, and allow the ſenſible frog to aſcend between them. But when the cartilages are rendered immoveable by becoming bony, or by contraction of the

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the foot, the ſenſible frog is much confined in its motion. By this immobility of the cartilages, the horſe is deprived of a powerful ſpring. When the frog does not preſs on the ground, and conſequently the cartilages are deprived of motion, the moiſture of the cruſt evaporates; and hence the quarters and heels of the hoof become contracted much more than the fore part of the cruſt, and this contraction is increaſed by the frog not being allowed to riſe between the cartilages. Thus, the natural circular ſhape of the hoof is deſtroyed by the frog not receiving preſſure.

Fig. 18. repreſents the lower part of a horſe's hoof, as it is uſually lengthened or contracted by improper ſhoeing.

128 Senſible ſole.

We have not yet deſcribed the ſenſible ſole. This is ſituated between the horny ſole and the coffin-bone, and is united to the lower cartilages immediately behind the latter (C C, fig. 15.). Its lower edge is firmly connected with the ſenſible laminæ, at the lower edge of the coffin-bone; but at the extremity of the heels, the laminæ are continued for about an inch, forming what are called the *ſenſible bars*. The ſenſible ſole is well ſupplied with blood-veſſels, but when theſe are emptied, it appears of a ligamentous texture. From the veſſels of this part, the horny matter of the horny ſole and bars is formed and renewed.

129 Coronary ligament.

The only other part of the foot that we ſhall deſcribe, is an important ligament, which ſurrounds the junction of the coffin-bone with the hoof, and is called the *coronary ligament*, (D D, fig. 16.) This ligament is attached at its upper part, to the anterior protuberance of the coffin-bone, and to the lateral cartilages; and extends a little above the coffin joint, being united on its outſide to the ſkin. Below it is united to the ſenſible laminæ, at their origin. On its outſide it is convex, and is received into a correſpondent hollow in the cruſt, called the *coronary ring*. It is ultimately inſerted into the heels of the ſenſible frog. The uſes of this ligament are very important. By its union with the ſenſible laminæ, lateral cartilages, ſenſible frog, and coffin-bone, it aſſiſts the action of all theſe parts, increaſing their ſtrength and connection; and in particular, preſerves the proper ſituation of the cartilages, and prevents their being diſlocated, to which they would otherwiſe be liable, by being ſeparated by the riſing of the ſenſible frog between them, when the horny frog touches the ground.

We have thus deſcribed the ſtructure and functions of the foot and hoof, as far as appeared to us to be abſolutely neceſſary for underſtanding the principles and practice of ſhoeing. The names, inſertions, and uſes of the muſcles of the foot, have been already conciſely given in the table of the muſcles of the extremities (ſee page 437.) The blood-veſſels, nerves, and abſorbents are well deſcribed, and moſt beautifully figured in Mr Coleman's elegant work on the ſtructure, economy, and diſeaſes of the foot of the horſe; to which, and to Mr Freeman's work on the ſame ſubject, we refer ſuch of our readers as wiſh for a complete and accurate account of that curious and important piece of mechaniſm, the foot of the horſe.

Anatomy of the Horſe.

We ſhall conclude this chapter with a ſummary recapitulation of the more important circumſtances that have been mentioned, as we ſhall immediately apply them in deſcribing the moſt approved method of ſhoeing; and they will be the better underſtood, and the more eaſily remembered, by being brought together in a comprehenſive point of view. It appears then,

130 Recapitulation.

"That the natural form of the hoof of the fore feet of horſes, before any art has been employed, approaches to a circle; and,

"That the internal cavity of the hoof, when circular, is completely filled by the ſenſible parts of the foot.

"That the hoof is compoſed of horny inſenſible fibres, that take the names of cruſt, ſole, bars, and frog.

"That the cruſt is united with the laſt bone of the foot, by a number of laminated elaſtic ſubſtances.

"That the uſes of the laminæ are to ſupport the weight of the animal, and from their elaſticity to prevent concuſſion.

"That the horny ſole is externally concave, internally convex, and united by its edge with the inferior part of the cruſt.

"That the uſes of the horny ſole are to act as a ſpring, by deſcending at the heels; to preſerve the ſenſible ſole from preſſure, and (with its concavity) to form a convexity of the earth.

"That the external bars are nothing more than a continuation of the cruſt, forming angles at the heels.

"That the internal bars are a continuation of the laminæ of the cruſt, attached to the horny ſole at the heels within the hoof; and that theſe inſenſible laminæ are intimately united with ſenſible laminated bars, connected with the ſenſible ſole.

"That the uſe of the external bars, is to preſerve the heels expanded; and the uſe of the internal horny bars, to prevent ſeparation and diſlocation of the horny ſole from the ſenſible ſole.

"That the external frog is convex, and of an inſenſible horny elaſtic nature.

"That the internal ſenſible frog is of the ſame form, very highly elaſtic, and united with two elaſtic cartilages.

"That the frogs are not made to protect the tendon, as Mr St Bel and other writers have ſuppoſed.

"That the uſe of the frog is to prevent the horſe from ſlipping, by its convexity embracing the ground; and from the elaſticity of the ſenſible and horny frogs they act as a ſpring to the animal, and keep expanded the heels" *.

* *Coleman on the Horſe's Foot*, vol. i.

PART

PART III. OF THE OPERATIONS USUALLY PERFORMED ON DOMESTIC ANIMALS.

Chap. I. *Of Shoeing.*

131 The principles and practice of ſhoeing are uſually explained at the end of treatiſes on the veterinary art, immediately after deſcribing the uſual ſurgical operations. We think it better, however, to treat on the ſubject of ſhoeing in this part of our article, immediately after having deſcribed the anatomy of the horſe's foot; the neceſſity of underſtanding which has been fully explained in the laſt chapter.

132 It is very uncertain at what period mankind firſt began to ſhoe their horſes with iron; but it is probable that this practice commenced as ſoon as they were ſufficiently civilized, to have ſuch roads as were compoſed of ſolid, hard materials, fitted for the purpoſes of conſtant traffic. In many countries where ſuch kind of roads are not required, as in the deſerts of Arabia, and in many eaſtern countries, we know that to this day the horſes are not ſhod; and we have been aſſured, that ſome years ago, when the roads in moſt of the United Provinces of America were not ſo hard as they are at preſent, horſes were ſhod only on the forefeet (D).

We ſhall firſt briefly deſcribe the mode of ſhoeing commonly practiſed by the ſmiths of this country, and ſhall then give a ſhort account of the moſt important improvements that have been made in the art, from the time of Laſoſſe to the preſent method employed at the veterinary college.

133 Common method of ſhoeing. In the common mode of ſhoeing, the bars are totally cut away, and the frog is conſiderably pared down, by means of a cutting inſtrument called a *buttreſs*. The reaſon aſſigned for cutting away the bars, or opening the heels, as it is called, is, that the heels may not contract, and that the ſhoe may not preſs upon the ſole, and occaſion corns. The hoof being thus prepared, the ſhoe is to be applied. The common form of this ſhoe is nearly elliptical, being broader at the fore part, and growing narrower towards the heels, where it is thicker than at the toe. It is convex on its outer ſurface where it is to touch the ground, and concave on its inner part, which is applied next the hoof. It is faſtened to the hoof by means of eight nails, four in each quarter; and the heads of theſe nails are nearly cubical, ſtanding out a little beyond the ſhoe. This ſhoe is commonly applied nearly red-hot, in order, as we ſuppoſe,

(D) Attempts have been made to prove that the ancients underſtood the uſe of iron ſhoes, and paſſages have been quoted both from Greek and Roman writers to ſupport this aſſertion. But we think that the learned Beckman has fully demonſtrated the fallacy of this opinion, and has ſhown, that although leathern ſhoes were ſometimes employed on the feet of horſes and other beaſts of burden, the uſe of iron horſe-ſhoes was entirely unknown both to the Greeks and Romans. Indeed, if ſuch ſhoes were in uſe among them, the ancient authors who have treated on horſemanſhip, huſbandry, and the veterinary art, as Xenophon, Julius Pollux, Columella, and Vegetius, could not poſſibly have omitted to notice them. It cannot be ſuppoſed that theſe writers would have been ſilent with reſpect to the ſhoeing of horſes, when they treat ſo particularly of the breeding and rearing of theſe animals, and preſcribe remedies for the accidents and diſeaſes to which they are ſubject.

Beckman is of opinion that iron horſe-ſhoes were uſed in Europe as early as the ninth century, for in the works of the emperor Leo, who lived about that period, they are expreſsly mentioned by the name of σιλιγνια σιδηρα. The emperor alſo ſpeaks of horſe-ſhoe nails by the appellation of καρφια, and mentions that a certain number of pounds of iron ſhould be given out from the imperial ſtores to make σιλιγνια, and other horſe furniture. The antiquity of horſe-ſhoes is alſo confirmed by their being ſpoken of in the writings of Italian, French, and Engliſh authors of the ſame century. "When Boniface marquis of Tuſcany, one of the richeſt princes of his time, went to meet Beatrix, his bride, mother of the well-known Matilda, about the year 1038, his whole train were ſo magnificently decorated, that his horſes were not ſhod with iron, but with ſilver. The nails were even of the ſame metal; and when any of them dropped out, they belonged to thoſe who found them. The marquis ſeems to have imitated Nero; but this anecdote may be only a fiction. It is related by a cotemporary writer, but unfortunately, his account is in verſe; and the author, perhaps, ſenſible of his inability to make his ſubject ſufficiently intereſting by poetical ornaments, availed himſelf of the licence claimed by poets to relate ſomething ſingular and uncommon. However this may be, it is certain that the ſhoes of the horſes muſt have been faſtened on with nails, otherwiſe the author could not have mentioned them.

"Daniel the hiſtorian, ſeems to give us to underſtand, that in the ninth century, horſes were not ſhod always, but only in the time of froſt, and on other particular occaſions. The practice of ſhoeing appears to have been introduced into England by William the Conqueror. We are informed that this ſovereign gave the city of Northampton as a fief, to a certain perſon, in conſideration of his paying a ſtated ſum yearly for the ſhoeing of horſes: and it is believed that Henry de Ferrers, or de Ferriers, who came over with William, and whoſe deſcendants ſtill bear in their arms ſix horſe-ſhoes, received that ſurname, becauſe he was entruſted with the inſpection of the farriers. We may here obſerve, that horſe-ſhoes have been found with other riding furniture, in the graves of ſome of the old Germans and Vandals in the northern countries; but the antiquity of them cannot be aſcertained." *Beckman on Inventions*, vol. ii.

Operations. suppoſe, to adapt it better, and make it fit cloſer to the hoof.

134 Defects of the common mode.

The conſequences of this method of ſhoeing muſt be, 1. That the function of the bars, whatever it may be, (and we have ſhewn that they are intended to prevent contraction of the feet,) muſt be deſtroyed. 2. That cutting away the frog, expoſes this part to injury, and is productive of many diſeaſes. 3. That the heels of the ſhoe being higher than the toe, will prevent the frogs from embracing the ground, for which we have ſhewn they were naturally intended. 4. That by making the ſhoe concave at the quarters, and placing the nails near the heels, the growth of the cruſt in theſe parts is impeded, and thus the foot is contracted, and its proper ſhape deſtroyed. 5. That by faſtening the ſhoe near the inſenſible frog at the heels, the proper action of the frogs and ſole, as a ſpring to aſſiſt the motions of the animal, is deſtroyed. 6. That by putting on the ſhoe hot, the moiſture of the cruſts is dried up, and thus the contraction of the foot is ſtill farther increaſed; and, 7. That by making the ſhoes rounded next the ground, the ſure footing of the horſe is greatly leſſened, much to the danger of his rider.

135 Lafoſſe's method.

The firſt modern writer who attempted to reform the common mode of ſhoeing, appears to have been Lafoſſe. It is true that an exeellent mode of ſhoeing was recommended about 300 years ago by Cæſar Fiaſchi, an Italian writer on horſemanſhip; but his plan never came into general uſe, and Lafoſſe appears to have all the merit of the improvement, as it is more than probable that he had never ſeen Fiaſchi's work. The ſhoe recommended by Lafoſſe was what he called the *half-moon ſhoe*, being nearly ſemicircular, and reaching little further than to the middle of the foot; the nails being placed round the toe. Lafoſſe's ſhoe was never very generally employed in this country, even though the improvement was rendered familiar by Bracken and Bartlet, who, as we have ſaid, tranſlated Lafoſſe's treatiſe into Engliſh. It has been conſidered as uſeful in ſome caſes of diſeaſed feet, and for ſtrong feet which have begun to contract, or appear likely to do ſo, provided ſuch horſes are not employed on very hard, rough roads; but it is by no means applicable to the majority of our horſes. Its principal diſadvantages appear to be, that the heels wear too faſt, and that in running, horſes are apt to ſlip with it.

136 Oſmer's method.

Mr William Oſmer, whoſe work on ſhoeing we have mentioned in N° 65. improved conſiderably on the ſhoe of Lafoſſe. He forbade the frogs and bars to be cut away, except when they were ragged. He however, remarks, that the feet of all horſes ſhould be pared according to their length; the cruſt being made perfectly ſmooth by paring or raſping. His ſhoe was everywhere of an equal thickneſs, rather narrower behind than before, of a flat ſurface next the ground, and bevilled away from about the middle of its breadth inwards, leaving a flat ſurface for the cruſt to reſt on.

137 Lord Pembroke's method.

The next improver of ſhoes was Lord Pembroke, though Mr Blaine moſt unaccountably places him after Mr Clark. Lord Pembroke's remarks on ſhoeing are exceedingly ingenious. He obſerved that the weight of ſhoes muſt, in a great meaſure, depend on the quality and hardneſs of the iron. If the iron be very good it will not bend, and in this caſe the ſhoes cannot poſſibly be too light; care, however, muſt be taken, that they be made of a thickneſs ſo as not to bend, for bending would tear out the nails, and ruin the hoof. That part of the ſhoe which is next the horſe's heel, muſt be narrower than anywhere elſe, that ſtones may be thereby prevented from getting under it, and ſticking there, which otherwiſe would be the caſe, becauſe the iron when it advances inwardly beyond the bearing of the foot, makes a cavity, wherein ſtones being lodged, would remain, and by preſſing againſt the foot, lame the horſe. The part of the ſhoe which the horſe walks upon, ſhould be quite flat, and the inſide of it likewiſe; and only juſt room enough ſhould be left next the foot, to put in a picker, (which ought to be uſed every time the horſe comes into the ſtable, and often on marches) and alſo to prevent the ſhoe's preſſing upon the ſole. Three, or at moſt four nails of a ſide, hold better than a greater number, and keep the hoof in a far better ſtate. He adviſes that the toe of the horſe be cut ſquare and ſhort, and that no nails be placed in that part. By theſe means narrow heels are prevented, and many good effects produced. His lordſhip adviſed the hinder feet to be ſhod in the ſame manner as the fore-feet, except in hilly and ſlippery countries, where the ſhoes on the hinder feet may be a little turned up behind. Operations.

The utmoſt ſeverity, (ſays Lord Pembroke), ought be inflicted on all thoſe who clap ſhoes on hot. This unpardonable lazineſs of farriers in making feet fit ſhoes, inſtead of making ſhoes fitting feet, dries up the hoofs and utterly deſtroys them. Frequent removals of ſhoes are detrimental, and tear the foot, but ſometimes they are very neceſſary. This is an inconvenience which half ſhoes are liable to (though excellent in ſeveral other reſpects), for the end of the ſhoe being very ſhort, is apt to get ſoon into the foot, and conſequently then muſt be moved.

138 Mr Clark's method.

The ſhoe recommended by Mr Clark did not differ very much from that of Oſmer. He does not, however, recommend the hollowing of the ſurface of the ſhoe next the foot. Mr Clark recommended that the hoof and frog ſhould not be pared or cut away without neceſſity, and was much againſt raiſing the heels with calkins; to the uſe of which he preferred that of an ice nail. He, however, admits, that ſharp calkins may be neceſſary in hilly countries.

139 Method of the veterinary college.

The ſhoe originally uſed at the veterinary college by the firſt profeſſor, was very ſimilar to that of Oſmer; but when Mr Coleman ſucceeded to the profeſſorſhip, he adopted the half-moon ſhoe introduced by Lafoſſe. This was, however, ſoon given up, as experience ſhewed that it was not adapted to the generality of horſes in this country. Within theſe few years, a method of ſhoeing has been introduced by Mr Coleman, which appears in moſt inſtances preferable to any former method. We ſhall therefore conſider it pretty much at large.

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Mr Coleman has laid down two general principles, by which the practice of ſhoeing for all horſes, in every country, muſt be invariably followed. "So long as nails and iron are employed to protect the hoof, the cruſt is the part that ſhould receive the nails, and the preſſure of the ſhoe; and the ſole of every horſe employed for every purpoſe, is a part that ſhould *not* be in contact with the ſhoe." Theſe are Mr Coleman's general rules, and to theſe it muſt be added, that the

frog

Operations. frog ſhould, in almoſt every caſe, be allowed to come in contact with the ground, where this is practicable, whenever the horſe ſets down his foot.

Two general circumſtances are to be obſerved in ſhoeing; the cutting of the hoof, and the application of the ſhoe. Some parts of the hoof require to be removed, before the ſhoe can be applied; while others muſt be carefully preſerved. Theſe circumſtances are at leaſt of as much conſequence as the form of the ſhoe, but are not in general ſo fully attended to.

In Mr Coleman's method of ſhoeing, he firſt recommends that a part of the horny ſole between the whole length of the bars and cruſt, be pared away with a drawing knife, as the heels of the ſole cannot receive the preſſure of the ſhoe, without corns being produced. The ſole muſt therefore be laid hollow, that it may not come in contact with the ſhoe. This he conſiders of the greateſt conſequence. The heels of the ſhoe muſt be made to reſt on that part of the hoof where the bars unite with the cruſt. See fig. 19. If the heels have been previouſly lowered by means of the butteris, there may perhaps not be left ſufficient ſole to admit of the application of the drawing knife, without penetrating to the ſenſible ſole; ſo that it is better, firſt to cut the ſole, as it may then be eaſily determined how far the heels may be lowered, and the toe ſhortened, with propriety. When the hoof is cut in this way, the ſole readily deſcends when the hoof touches the ground, without being obſtructed by the ſhoe; and ſtones, or other foreign bodies that have gotten between the ſhoe and the hoof, are thus readily puſhed out. It is found by experience, that the ſole never ſuffers from ſtones and gravel, when there is ſufficient ſpace left between the bars and the cruſt. The cavity between the ſole and ſhoe ſhould alſo be left ſufficiently wide after the ſhoe is applied, to admit of the introduction of a large horſe-picker, eſpecially between the bars and the cruſt. If the ſole ſhould be naturally concave, a ſhoe that has a flat ſurface next the hoof will not touch any part of the ſole when applied to the cruſt; and even ſhould the ſole be flat, or rounded in the middle or towards the toe, yet the quarters and heels may generally be made ſufficiently hollow by the drawing knife, to avoid preſſure on a flat ſhoe.

141 If it is found that a ſhoe with its upper ſurface flat, does not leave a ſpace large enough to admit the picker between it and the ſole, it is neceſſary to make either the ſole or the ſhoe a little hollow. Sometimes the ſole appears ragged and in flakes, and of conſiderable thickneſs. It is then proper to make the whole of the ſole hollow with the drawing knife, before attempting to lower the heels or ſhorten the toe. When the ſole is made hollow, the ſhoe will reſt only on the cruſt; but if we cannot hollow the ſole, we muſt, to prevent preſſure, make the upper ſurface of the ſhoe hollow. As the hoof is always growing, and is preſerved from friction by the ſhoe, it is neceſſary to pare the toe of the cruſt about once in every month. The more we can remove from the toe of the cruſt, in hoofs that are not well ſhaped, the ſooner we ſhall be able to apply a ſhoe of the proper form and thickneſs.

142 Bars and frog not to be cut away. "The bars and frog ſhould never be removed. Where there are ragged and detached parts of the frog, it is better that they ſhould be cut with any ſmall knife, by the groom, than by the farrier; for if the latter is once allowed to touch the frog, the ſound parts are generally deſtroyed. Where the frogs are not large and projecting, and the heels are higher than the frogs, then it is adviſeable to lower the heels, which may be done by a raſp, or the butteris; for in every caſe we are to endeavour to bring the frog in contact with the ground. We ſhould never loſe ſight of this principle, that the frog muſt have preſſure, or be diſeaſed. If the frog does not touch the ground, it cannot perform its uſe; and no organ can be preſerved in health, that does not perform the functions for which it was made." * Nevertheleſs, where the frog has been diſqualified for its functions for a conſiderable period, and become ſoft, it muſt be accuſtomed to preſſure by degrees." * Operations.

* *Coleman on the Horſe's* vol. i. 143

When it is neceſſary for the horſe to work, though his frog is ſoft and diſeaſed, it muſt be gradually accuſtomed to preſſure, by cutting down the hoof about one-tenth of an inch at every freſh ſhoeing, that the frog may become hard, and equally protuberant with the heels. If the horſe be not required to labour, much advantage will be derived from allowing him to ſtand in the ſtable without ſhoes.

144 Shoe to be adapted to the hoof. The feet of moſt horſes have been deformed by bad management. It will therefore be neceſſary to uſe a particular ſhoe to each particular form of hoof. Any one form employed indiſcriminately for all feet, cannot be alike ſucceſsful for all. It is from not having ſufficiently attended to this ſimple fact, that the ſhoe recommended by the veterinary college has not been more generally adopted. It is therefore neceſſary to vary the length, breadth, and thickneſs of the ſhoe, according to the form of the hoof to which it is to be applied. If the heels or fore-feet are two inches and a half or more in depth; if the frog be ſound and prominent, and the roads dry, the toe of the hoof only requires to be ſhortoned, and afterwards covered by a ſhort ſhoe, which may be made of the uſual thickneſs at the toe, but muſt be thinner gradually towards the heel. The proportional thickneſs of a ſhoe of this kind for a common ſaddle-horſe, as recommended by Mr Coleman, is three-eighths of an inch at the toe, and one-eighth at the heel. By means of ſuch a ſhoe the frog is completely brought in contact with the ground; the heels are expanded; and corns, thruſhes, and canker are prevented. The horſe may continue to wear ſuch a ſhoe as long as the weather is warm, and the ground dry.

Race-horſes, who generally have the heels high, and the cruſt thicker and ſtronger than heavy horſes, may generally wear ſhort ſhoes, at leaſt on the fore-feet. But ſuch as have weak legs, bent knees, long paſterns, or low heels, muſt not wear ſuch a ſhoe. 145

146 Changes to be made gradually. A long ſhoe is neceſſary in wet weather, and even in ſummer, when the heels of the hoofs are low. In winter, when the heels are too high, they ſhould be lowered by means of a raſp, rather than ſuffered to wear down, by being expoſed to the ground with a ſhort ſhoe; for moiſture is very deſtructive to the hoof; and thus as great a part of it may be removed as is neceſſary. Beſides, when a horſe has been accuſtomed to high-heeled ſhoes, if he was ſuddenly made to wear thoſe with thin heels, the frog might be bruiſed or inflamed, and the muſcles and tendons of the leg conſiderably ſtrained. It is therefore neceſſary to bring the heels of the ſhoe to the proper degree of thinneſs gradually,

Operations. dually, obſerving that the heels of each ſucceeding ſhoe be made ſomewhat thinner than thoſe of the laſt. In general, as much as poſſible of the horny part of the hoof next the toe is to be removed, and as little iron employed next the heels every time of ſhoeing, till the feet be brought as nearly as may be to their natural ſhape.

147 In horſes that have been accuſtomed to wear ſhoes of an equal thickneſs all round, and where the frog is healthy, we may in general apply a ſhoe, much thicker at the toe than the heel, by paring down the toe, and taking nothing from the heel; and if a horſe appear to ſuffer no inconvenience from a thin-heeled ſhoe, during the firſt month after it is applied, it may be continued with ſafety, and will greatly improve the hoof. In young horſes, however, that have never been ſhod, and in horſes juſt taken up from graſs, the toe ſeldom admits of being pared down, and a thin-heeled ſhoe cannot be applied at once.

148 In all caſes where the frog does not embrace the ground with a thin ſhoe, the heels muſt be lowered; and if the horſe has been accuſtomed to wear high-heeled ſhoes, both the ſhoe and the hoof muſt be gradually lowered, till the frog can ſafely and eaſily perform its proper function.

A few horſes require to be ſhod in a manner different from that which we have deſcribed, but ſtill dependant on the ſame principles.

149 Weight of ſhoes. Different weights of ſhoes are required for different horſes. Mr Coleman lays down the following proportions, for horſes of various deſcriptions.

150 For a coach-horſe A moderate-ſized coach-horſe will require a weight of ſhoes and nails, from eighteen to twenty ounces; an inch wide, and half an inch thick at the toe, and three-fourths of an inch wide, and one-ſixth of an inch thick at the heels.

151 A ſaddle horſe. An ordinary ſaddle-horſe will require only from 12 to 14 ounces; and the ſhoe may be three-fourths of an inch wide at the toe, and half an inch at the heel, and three-eighths of an inch thick on the outſide of the toe, but only one-eighth at the inſide of the toe, and at the heel.

152 Coleman's ordinary ſhoe. The ſhoe moſt recommended by Mr Coleman, is concave on its upper ſurface, where the ſole is flat or convex, but it is flat on the reſt of the upper ſurface; but if the ſole admits of being hollowed, the whole upper ſurface may be flat. It is regularly concave on its lower ſurface next the ground; and it is faſtened to the cruſt by means of eight nails placed round from the toe backwards, ſo as to leave a part of the ſhoe about an inch and a half from the heel. Hunting-horſes uſually require an additional nail on each ſide, next the quarter. The nail-holes are made with a punch of a wedge-like form, and to correſpond to this the heads of the nails are made conical, ſo that as long as any part of the head of the nail remains in the hole, the ſhoe cannot eaſily come off.

153 For hunters, and ſuch horſes as run in ſhafts, it is recommended by Mr Coleman to turn up the outer heel; but, as in this way there is often ſome inequality of poſition, the outer heel of the foot is to be lowered, while the inner heel of the ſhoe is ſomewhat thickened. By theſe means cutting is avoided.

In ſuch horſes as have weak low heels, Mr Coleman recommends the uſe of the bar-ſhoe, as the bar affords a ſupport to the frogs, without wearing out the heels. When the bar-ſhoe has been employed long enough to admit of the heels growing to the proper ſize, the ordinary thin-heeled ſhoe may be adopted. Operations.

154 The method recommended by Mr Coleman, as deſcribed above, has been for ſome time followed with conſiderable ſucceſs by the board of ordnance, whoſe horſes, as well as thoſe of the Britiſh cavalry in general, are now ſhod after this manner. The method has, however, met with conſiderable oppoſition, partly from ſuch as do not underſtand the principles on which it is founded, and partly from its having been too haſtily adopted, in caſes to which, as Mr Coleman himſelf allows, it is not generally applicable.

Fig. 19. and 20. illuſtrate Mr Coleman's method of ſhoeing.

Fig. 19. repreſents the hoof turned upwards, to ſhew the manner in which the ſhoe is applied. It may be ſeen from this figure that the web of the ſhoe is hollow; that the heels at *a a* are narrower than the other parts of the ſhoe, and that the nails are placed all round from the toe backwards. Fig. 20. ſhews that the heels of the ſhoe are much thinner than the point, and alſo ſhews the manner in which the nails are rivetted or clinched on the outſide of the hoof round the toe and cruſt.

155 Mr Morecroft's method. The only remaining method of ſhoeing that we ſhall here mention, is that of the ingenious Mr Morecroft. This gentleman has acquired much celebrity by his invention of *caſting* ſhoes, by ſinking them in dies, by which means horſes may be fitted with any ſhoes beſt adapted to their hoofs. Mr Morecroft's ſhoe differs from Ofmer's, in being concave within for more than half its width. He condemns the uſe of calkins, on the principle that the public roads are now much more ſolid than when calkins were in general uſe; and, conſequently, that inſtead of ſinking them into the ground, they rather tend to raiſe the heels above it, and thus the frog is prevented from receiving the neceſſary preſſure. Mr Morecroft, however, allows calkins to heavy draught-horſes, for whom he recommends two on each ſhoe; but in lighter horſes of the ſame deſcription, one on the outſide of each ſhoe. The latter is alſo recommended for hunters, but for other riding horſes, he forbids the uſe of calkins. The number of nails in Mr Morecroft's ſhoe is uſually eight, but in heavy draught-horſes they are not to be placed on the ſides of the ſhoe, but all round at equal diſtances, leaving a ſpace at the heels of about two inches or two inches and a half. In froſty weather, Mr Morecroft recommends nails with a lozenge head, or a double counterſink, terminating in an edge inſtead of coming to a point, which greater breadth of ſurface prevents its being rubbed away ſo faſt as a point. The thickneſs in the middle gives it ſtrength, and the regular taper to the ſhank cauſes it to apply exactly to the ſide of the hole in the ſhoe, by which it is equally ſupported, and prevented from bending or breaking.

156 Coleman's artificial frog. Mr Coleman conſidering preſſure as neceſſary to the healthy action of the frog, has contrived a method of affording this preſſure in thoſe caſes in which, from diſeaſed feet, or bad management in ſhoeing, it cannot naturally receive it; and where, if the heels were lowered, in order to bring the frog in contact with the ground, there would be danger of ſtraining the tendons. Mr Coleman's patent artificial frogs are intended to produce

Operations. duce preſſure on the natural frogs, while the horſes are ſtanding in the ſtable, and thus to give time for the growth of the heels, and to avoid the evils that would ariſe from lowering theſe too ſuddenly, or from allowing the frog to remain elevated above the ground. For the particulars of this ingenious invention, we muſt refer to Mr Coleman's pamphlet.

157 Shoes for oxen. Where oxen are worked in farming buſineſs like horſes, it is generally thought neceſſary to defend their hoofs in a ſimilar manner by means of iron ſhoes. The form and manner of fitting theſe do not appear to be univerſally the ſame in all places; nor are we acquainted with the methods uſually practiſed. We know that M. St Bel recommended the following methods; either to ſhoe the ox with a flat plate of iron, having ſix or ſeven nail-holes on the outer edge, accompanied with a projection of four or five inches of iron at the toe, which paſſing the cleft of the foot, is bent over the hoof: or with eight ſhoes, one under each nail; otherwiſe with four, one under each internal nail; or only two, one under the external nail of each fore-foot.

Chap. II. *Of Caſting.*

158 Caſting. There are ſeveral tedious and painful operations that we are ſometimes obliged to perform, and which it would be difficult, or impoſſible to execute, were the animal left at full liberty to reſiſt us. It is, therefore, neceſſary to render ourſelves completely maſters of him, by throwing him down on the ground, and in a convenient ſituation, ſo as not to expoſe him or ourſelves to injury. This operation is called *caſting*, and is uſually thus performed.

The firſt object is to prepare a thick bed of ſtraw or litter, not leſs than eight feet ſquare, to prevent the animal from being hurt in the fall. If the ſtable be ſufficiently large to admit of the bed being made there, it is to be preferred, as, during the operation, to prepare for which caſting is neceſſary, the parts operated on will ſuffer leſs from expoſure to the air in the ſtable, than without doors.

But, if there is not room in the ſtable, the bed muſt be made in the ſtable-yard, or rather, if poſſible, in ſome field or park adjoining.

The animal is now to be brought to one ſide of the bed; a ſtrong leather ſtrap, with a buckle at one end, and having an iron ring fixed to it, at a convenient diſtance from the buckle, is to be fixed round the paſtern of each of the four legs, in ſuch a way, that the rings of the ſtraps that are round the fore-feet ſhall be directed backwards, and thoſe of the ſtraps on the hind-feet ſhall be oppoſite to theſe; while the buckles point outwards, to prevent hurting the animal. A pretty ſtrong cord, ten or twelve feet long, is to be faſtened to the ring of that ſtrap that has been placed on the fore-foot on that ſide of the animal which is fartheſt from the bed: from this ring it is to paſs through the ring on the hind-foot, on the ſame ſide, from which it paſſes through the ring on the other hind-foot, then through the ring on the other fore-foot, and laſtly, through that to which it was firſt faſtened. The animal being thus fettered, a number of men are to place themſelves beſide him, ſo that he may be between them and the bed, while others are to ſtand on the oppoſite ſide of the litter. Now, the men that are beſide the animal, laying hold of the end of the rope, are to pull gradually with conſiderable force, ſo as to bring the four feet of the animal as near as poſſible together. When this is done, the men on the other ſide, ſtanding in a row, one at the head of the animal, another at his cheſt, a third at his haunches, a fourth at his tail, &c. pull the animal toward them and complete his fall.

It is neceſſary to obſerve that the men who pull the rope, and thoſe who receive the animal on the bed, muſt not act at the ſame time; as in this caſe the ſhock would be ſo great and ſudden, as probably to occaſion ſome accident, either to the men or to the animal. It is alſo proper to remark, that the animal muſt be caſt in ſuch a manner, that the part to be operated on may be fully in the view and reach of the operator.

When the animal is once on the bed, his head muſt be held down by a man, and it will be proper to cover his eyes. Another aſſiſtant muſt ſtand by the cord, which for greater ſecurity, ſhould be faſtened with a knot at the firſt ring.

There are ſome little nicetie to be obſerved in caſting an animal, according to the operation that is intended to be performed on him; but of theſe we ſhall ſpeak, when we deſcribe the operations themſelves.

Chap. III. *Of Bleeding.*

159 Bleeding. Bleeding is diſtinguiſhed into *general* and *local*. General bleeding is performed for the purpoſe of taking away a quantity of blood from the general maſs, and conſiſts in opening ſome large vein, or ſome conſiderable branch of an artery. The vein uſually opened, in horſes and cattle, is the vein that runs along the neck, and which is called the *jugular vein*. This vein may be eaſily felt, as it is generally conſiderably raiſed above the muſcles.

The vein is uſually opened by means of a fleam, which is forced into the vein, by ſtriking it with a ſmall wooden mallet, called by farriers a *blood-ſtick*. There are many objections to this mode of bleeding. In the firſt place, it is extremely clumſy; and, if the vein happens to roll, which is very commonly the caſe, a large wound may be made in the ſkin, without drawing blood. Again, theſe animals, eſpecially horſes, are eaſily frightened by any ſudden motion of the hand; and ſome perſons have a way of ſhaking the blood-ſtick before they give the ſtroke; and, in doing this, they often uſe more exertion than is neceſſary. The animal alarmed at theſe ſtrange motions, toſſes up his head, and thus renders the ſtroke uncertain.

Many prefer the ordinary lancet uſed by ſurgeons; and, in ſeveral caſes, particularly of local bleeding, this is the moſt convenient inſtrument. But in opening the jugular vein, we do not conſider it as much ſuperior to the common fleam. When this latter is employed, the back of it ſhould be made of conſiderable thickneſs, as, when it is too narrow, as is commonly the caſe, when the inſtrument is ſtruck with the ſtick, it ſinks into the channel of the vein, which is often not opened, as the prominent muſcles of the neck receive the ſtroke.

For moſt purpoſes of bleeding, we would recommend the ſpring-fleam, as being eaſily applied, and much more certain in its effect.

160 Danger of uſing a ligature about the neck.

It is a common practice with grooms and farriers, to tie a rope or other ligature about the neck of the animal,

Operations. animal, previous to the bleeding in the jugular vein. They do this from a ſuppoſition that the vein will thus ſwell the more readily, and that it will be opened with greater certainty. But this ligature is in moſt caſes unneceſſary, and will at ſome times be highly dangerous.

Where exerciſe is not improper before bleeding, it will be ſufficient that the animal be gently trotted previous to the operation, as thus the circulation will be promoted, and the ſuperficial veins will be ſufficiently filled with blood. Where general exerciſe is improper or inadmiſſible, the filling of the vein may eaſily be promoted by briſkly rubbing the neck for ſome time with a wiſp of ſtraw or hay; and juſt before applying the fleam, it will be proper to preſs with one finger upon that part of the vein that is between the ſhoulder and the place where the fleam is applied.

The danger of a ligature will appear both from reaſon and experience. When the ligature is faſtened round the neck, it produces a ſwelling of the vein on each ſide; and thus the circulation being in a great meaſure impeded, and the return of much of the blood from the head prevented, an accumulation of blood takes place in the veſſels of the brain. If the ligature be continued round the neck, which muſt happen when, by want of dexterity of the operator, or by the horſe being frightened, the vein has not been opened at the firſt attempt, the ſtagnation of the blood in the head goes on to an alarming degree, and the horſe not unfrequently falls down in an apoplectic fit. "In ſuch caſes, (ſays Mr Clark), I have obſerved the operator greatly diſconcerted, and deſiſt from any further attempts to draw blood at that time, being prepoſſeſſed with the idea that the horſe was vicious and unruly, although the very treatment the horſe had juſt undergone rendered bleeding at this time the more neceſſary, in order to make a ſpeedy revulſion from the veſſels of the head; therefore a ligature or bandage ought never to be uſed till ſuch time as the opening is made into the vein, and even then it will not be neceſſary at all times, if the horſe can ſtand on his feet, as a moderate preſſure with the finger on the vein will make the blood flow freely; but if the horſe is lying on the ground, a ligature will be neceſſary."

But further, the concuſſion or ſhock the horſe receives from his falling down, in the above ſituation, which will always happen if the ligature is too long continued, may cauſe a blood-veſſel in the head to burſt, and death may be the conſequence.

161 Place where the vein is to be opened.

The place where the vein is to be opened is of ſome conſequence, as, when the opening is made too far from the head, where the vein lies deep among the muſcles, both the vein is not ſo eaſily opened, and the wound is not ſo readily healed. The moſt proper place for opening the jugular vein is about an inch below the joining of the ſmall branches that come from the lower jaw. This is generally about a hand-breadth from the head, but it may be eaſily ſeen by the ſwelling of the vein when preſſure is made on its trunk.

Before opening the vein, it is uſual to wet the hairs that lie above it, and to ſtroke them in the direction of the intended orifice. This is a good practice, as the inſtrument thus paſſes though the ſkin more readily, not having to overcome the reſiſtance of the hair. In mentioning the direction of the orifice, it is worth while to remark, that this ſhould neither be longitudinal nor directly acroſs the vein, but rather oblique; as the flow of blood from an oblique orifice is moſt eaſily ſtopped.

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162 The blood to be ſaved.

When the vein is opened, it is highly proper in all caſes to catch the blood in ſome convenient veſſel. It is a very abſurd practice, although it is commonly adopted, to allow the blood to flow at random on the ground or on a dunghill, by which means no preciſe eſtimate can be made of the quantity of blood taken away. This may either be ſo ſmall, as to be of no advantage; or it may be ſo conſiderable as to produce fainting, before the operator thinks of ſtopping the orifice.

For the purpoſe of meaſuring the quantity of blood taken away, Mr White recommends a graduated tin veſſel, capable of containing five quarts; every pint being marked on the inſide of the veſſel, ſo that the quantity of blood that is taken off may be exactly known. The blood ſhould always be preſerved, that we may judge from its appearance of the nature of the diſeaſe, and whether it is proper, or not, to repeat the operation. If the blood continues fluid for a conſiderable time, it ſhows that there is an inflammatory ſtate of the body; and if a jelly-like ſubſtance, of a whitiſh or light buff colour, and rather firm conſiſtence, appears on the ſurface after the blood has cooled, and eſpecially if the ſurface is hollowed, we may be certain that the animal's complaint is of an inflammatory nature, that the bleeding has been proper, and muſt be repeated, if the ſymptoms continue or increaſe; but if the blood coagulates quickly, is uniformly of a dark liver colour, looſe, and eaſily broken, with a conſiderable quantity of water upon its ſurface, it denotes debility, and ſhews that the diſeaſe ariſes from a weakneſs of the ſyſtem; that inſtead of *bleeding*, *tonic* and cordial medicines are to be employed, with every thing that may tend to reſtore the animal's ſtrength *.

* *White's Materia Medica.*

163 Securing the orifice.

When a ſufficient quantity of blood has been taken away, it is for the moſt part neceſſary to ſecure the orifice, in order to prevent future accidental bleeding. This is uſually done by thruſting a common pin through the lips of the wound, and twining about it a little horſe hair. As in this way the wound often rankles, and becomes a ſore difficult to heal, which we are diſpoſed to attribute to the braſs pin employed, as often as to any other cauſe; we would recommend a pin of ſilver, or at leaſt of poliſhed ſteel. The pin need not paſs through more than the ſkin, and in ſome caſes when the horſe can conveniently be faſtened to the rack after bleeding, the pin may be entirely diſpenſed with.

As it is often required to bleed on either ſide of the neck, or on both ſides, it is proper that the operator ſhould be able to bleed with either hand. This is indeed not quite ſo neceſſary in bleeding horſes and cattle, as in the human ſubject; but it will be often found very convenient in both.

164 Opening the temporal artery.

In ſome caſes, eſpecially in inflammation of the brain, where a ſudden and copious loſs of blood is required, it becomes neceſſary to open the temporal artery. This is eaſily effected, as the artery is ſituated very ſuperficially, about an inch and a half backwards from the upper and outer corner of the eye. It is moſt conveniently opened with a lancet, and when a ſufficient quantity of blood has been drawn, the flow is in general very eaſily ſtopped by making continued preſſure upon the artery; or, if this ſhould not ſucceed, and a dangerous effuſion of

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of blood ſhould be apprehended, this may be effectually prevented by completely dividing the artery.

165 Caſes requiring bleeding.

General bleeding is one of the moſt efficacious remedies in moſt of the acute diſeaſes to which horſes and cattle are ſubject. "When a horſe appears dull and heavy, (ſays Mr White), and indifferent about his food, by bleeding we often prevent a fever. If a horſe is bled at the commencement of a cold, the complaint generally proves moderate, and of ſhort continuance. In all caſes of internal inflammation, or ſymptomatic fever, bleeding is the moſt eſſential remedy, provided the operation be performed at an early period, and the blood drawn in ſufficient quantity. In ſuch caſes I have often taken away five quarts, and repeated the operation the following day, when it appeared neceſſary. By bleeding copiouſly at firſt, theſe formidable diſeaſes are cruſhed at once; while by ſuffering them to proceed, or become at all violent, which they will do, unleſs this practice is adopted (or if only a ſmall quantity of blood is drawn) they generally prove fatal; nor will bleeding then be of any ſervice *."

* White's Materia Medica.

166 Cautions.

Mr Clark very juſtly remarks, "that although the caſes which may require bleeding are numerous, yet there is one general caution to be obſerved, viz. never to take away blood but when it is abſolutely neceſſary; as it is a fluid that may be eaſily taken away, but cannot be ſo eaſily replaced; beſides, that the practice of bleeding frequently, or at ſtated times, is exceedingly improper, as it diſpoſes the body to become lax, weak, and plethoric.

"In bleeding, therefore, a due regard muſt always be had to the conſtitution, age, ſtrength, &c. of horſes, and the ſtate or habit of body they are in at the time.

"It is commonly ſaid that the taking away a little blood from horſes, even when they are in health, or when they are in the leaſt indiſpoſed, will do no harm: this in one ſenſe may be allowed to be literally true; but why draw blood from them on every trifling occaſion, unleſs there may be ſuch ſymptoms attending as may require it? I have obſerved in many horſes who have been very frequently blooded, and which may be eaſily known, from the cicatrices or marks on the neck veins, that their blood had loſt much of its tenacity, together with a conſiderable portion of its florid and red colour. Butchers who ſlaughter calves, may find their account in bleeding them frequently, as it renders their fleſh white, by taking away the red particles of the blood. But in horſes it is quite otherwiſe; as they are deſtined for hard labour and active exerciſes, it impairs their conſtitutions, ſubjects them to diſeaſe, and haſtens a premature old age.

"As the blood of horſes, more eſpecially thoſe who are conſtantly employed in hard labour, or in active exerciſes, when drawn from a vein, appears of a darkiſh or deep red colour, even in the higheſt ſtate of health, it is commonly ſaid to be bad blood, and more ſo when a thick yellow or buff-coloured cruſt forms on the ſurface after it is cold; hence theſe appearances are ſaid to require repetition of bleeding; for it very unluckily happens, that moſt of the diſeaſes to which horſes are ſubject are thought to proceed from ſome impurities or humours, as they are called, in the blood, which require to be drained off by bleeding, and other evacuations *."

* Clark on preventing Diſeaſes in Horſes.

Topical bleeding is uſeful in ſeveral caſes, as in inflammatory affections of the feet, which are often relieved by opening the coronary veins, or the vein that encircles the coffin-bone; in inflammation of the eyes, in which blood may be often drawn, from the angular veins, with conſiderable ſucceſs; and in affections of the mouth, where it is ſometimes uſeful to draw blood, by ſcarifying the bars of the mouth, or even, in ſome urgent caſes, by opening the veins of the palate. Topical bleeding is beſt performed with a lancet.

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167 Topical bleeding.

Almoſt the only method that is practiſed for bleeding ſheep, or dogs, is to cut off a joint or two of the tail; and this is certainly often productive of good conſequences, as the flow of blood is ſometimes pretty conſiderable. Unfortunately, however, we can ſeldom have recourſe to this mode of bleeding more than once or twice, whereas caſes often occur in which it is neceſſary to repeat the bleeding. It is alſo a cruel method, and we ſee no reaſon why the veins in theſe animals may not be opened like thoſe of horſes and cattle. In the ſheep, indeed, the thickneſs of the wool will commonly prevent bleeding in the neck, but the temporal artery and the veins of the foot may be opened without difficulty; and in moſt dogs we may bleed in the jugular-vein with nearly as much eaſe, as in the horſe or cow.

Chap. IV. *Of making Rowels and Setons.*

168 Rowelling deſcribed.

Rowels in horſes and cattle are much the ſame as iſſues in the human body. The operation conſiſts in opening the ſkin, ſo as to inſert between it and the cellular membrane ſome foreign body, which is kept there, in order to produce and keep up a ſuppuration, or running of purulent matter. The operation is uſually performed in the following manner. An inciſion is made through the ſkin by means of a very ſharp pair of ſciſſars, or what appears better, a ſharp knife. The finger is then introduced below the ſkin, ſo as to ſeparate it from the fleſh all round, as far as the finger will reach. A piece of leather, about the ſize of a crown-piece, and of a circular form, with a hole cut in the middle, is then inſerted between the ſkin and muſcles, having been firſt anointed with ſome ſtimulating ointment. A ſmall piece of tow or caddice ſpread with the ſame ointment, is put over the hole in the centre of the leather; the ſkin is laid down over all, and the part is covered with a pledget, alſo covered with ointment, to keep out the external air.

The leather is left in this ſituation for two or three days, during which the parts adjoining the rowel ſwell, and at the end of the time there appears a diſcharge of a yellowiſh matter, which gradually becomes thicker and whiter. In three days at fartheſt the part muſt be examined, and the plug removed from the central hole, to allow the matter to flow out. The rowel is now complete, and may be continued as long as ſhall be found neceſſary. The action of the rowel is eaſily explained; the leather introduced excites a degree of inflammation between the ſkin and the fleſh, and no means being taken to check this, it goes on, like moſt other inflammations of fleſhy parts, to ſuppuration. Thus a diſcharge is produced from the part, which is found to have conſiderable effect in checking inflammation of ſome more important organ near which the

rowel

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rowel has been inſerted. Thus, in inflammation of the lungs, after copious bleeding, a rowel in the cheſt, like a bliſter in the human body, is found to have conſiderable effect in checking the progreſs of the diſeaſe.

169 Situations proper for rowels.

Rowels may be placed in moſt of the fleſhy parts of the body; but they are moſt commonly inſerted in the belly, the breaſt, the inſide of the thighs, the outſide of the ſhoulders, and the hips. They are ſometimes placed between the jaw-bones, below the tongue; but this is very improper, as a good ſuppuration can ſeldom be brought on in this place.

It is ſometimes found neceſſary to make ſeveral rowels at the ſame time; but they ſhould always be placed, as nearly as poſſible, to the ſeat of the affection which they are intended to relieve.

Beſides dangerous inflammations, rowels are found ſerviceable in large ſwellings of the hind legs, in obſtinate caſes of greaſe, and in ſtrains of the ſhoulder.

170 When improper.

Though rowels are thus found extremely uſeful in many caſes, they are, like many other operations performed on brute animals, ſometimes made where they are unneceſſary or improper. Where there is conſiderable debility, the inſertion of a rowel would be very injudicious, as it would not ſuppurate kindly, and as the diſcharge produced would tend ſtill farther to increaſe the debility. The diſcharge in theſe caſes is uſually thin and ichorous; ſometimes they are perfectly dry, and not unfrequently a mortification is produced. When a rowel is found to be attended with any of theſe effects, it muſt be immediately removed, and the parts muſt be fomented with a warm decoction of the chamomile-flowers, and ſome ſtimulating herbs; or muſt be bathed with ſpirit of wine or oil of turpentine. If gangrene ſhould have come on, it will beſides be neceſſary to adminiſter cordial and ſtrengthening remedies.

171 Setons.

Setons are inſerted through an opening made in two oppoſite parts of the ſkin, and the extraneous body introduced is a cord.

The opening is made by means of a ſharp-pointed inſtrument with an eye at the other end for receiving the cord. The ſides of the inſtrument muſt be proportioned to the opening to be made, and the ſize of the cord to be inſerted.

172 Their uſe.

Setons are particularly uſeful for the purpoſe of gradually draining off matter from abſceſſes or ſuppurating tumours, that are either ſo deeply ſeated as not to be eaſily opened in any other way, or ſo large that the ſudden diſcharge of matter from them while opened by the knife, would be attended with bad conſequences. They are beſt employed in large abſceſſes of the back withers, and the upper part of the neck behind the ears. Setons are alſo attended with the advantage of draining off the matter without expoſing the inſide of the abſceſs to the air.

173 Mode of introducing them.

The method of inſerting the ſeton for the purpoſe of opening an abſceſs is this. When it is found that there is a conſiderable accumulation of matter, the needle, furniſhed with a cord of the proper ſize, is to be introduced at the higheſt part of the tumour, and brought out towards its loweſt part, ſo that the matter may more eaſily drain off. The cord, which muſt previouſly be rubbed with ſtimulating ointment, is now to be cut from the eye of the needle, and then faſtened together at both ends, to prevent its being pulled out; but if the cord ſhould not admit of being thus tied, a ſmall button of wood may be faſtened on each end. It is better, however, if poſſible, to tie the ends together, as every time the ſore is dreſſed, the ſeton requires to be drawn a little round. When the diſcharge appears to be nearly ſtopped, except what evidently ariſes from the preſence of the cord, this may be gradually removed, by drawing out a ſingle thread of it at every dreſſing. Operations.

In introducing the needle, great care muſt be taken to avoid large blood-veſſels and nerves; and where there is a danger in encountering theſe, it is better to paſs the needle through a ſheath. This may eaſily be done, by firſt making a ſmall opening with a lancet at the upper part of the tumour; and through this introducing the ſheath, which is to be puſhed down till it reaches the part at which the needle is intended to come out. The needle in this way will paſs through the ſheath without danger of wounding any important nerve or veſſel.

Chap. V. *Of Firing.*

174 Firing.

This operation conſiſts in applying to the ſkin, or other parts of the body, a metallic inſtrument heated to a greater or leſſer degree of redneſs. The inſtrument is called a cautery, and the operation was well known among the ancient ſurgeons, by the name of the actual cautery.

The inſtruments employed for firing are uſually made of iron, ſometimes of copper; but iron is to be preferred. They are of various forms, according to the part to which they are to be applied, and the purpoſe for which the operation is to be performed. Theſe will be conſidered in deſcribing the caſes to which firing is applicable.

175 Its uſes.

The operation is found of uſe on ſeveral occaſions:

1ſt, In order to oppoſe the progreſs of mortification. With this view a cautery ſhaped like a knife, with a blunt edge and a thick back, is to be employed. This form will alſo anſwer for many other caſes. There ſhould be ſeveral inſtruments of the ſame kind, that when one becomes too cool, another may be ready of the proper degree of heat. The heat of the iron intended for the preſent caſe ſhould be that of a cherry-red. In applying the iron, the parts adjoining to the mortified place are to be paſſed over with the edge of the inſtrument in ſucceſſive parallel lines, ſo as the heat may penetrate to the living parts, and thus produce ſuch a degree of healthy action as may enable them to throw off the mortified ſlough. When the iron has been applied for a ſufficient time, which muſt be regulated by the nature of the part, and the extent of mortification, the wound is to be covered with a pledget ſpread with ſome ſtimulating ointment.

2d, Firing is employed to brace the ſkin, and to ſtrengthen the ſinews. The inſtrument above deſcribed is uſed on this occaſion, but its heat muſt be ſomewhat greater. The mode of applying it is to paſs the edge lightly and quickly over the ſkin, deſcribing parallel lines from one end of the part to the other. When one iron has been uſed in this way, a freſh one is to be taken, and made to retrace the lines firſt formed, beginning where the laſt iron left off; and this is to be repeated as often as appears neceſſary, taking care not to deſtroy the texture of the ſkin. It is recommended by

Operations. by ſome to apply the hot iron, ſo as to burn away the hair, for ſome time previouſly to firing the ſkin; as much time is otherwiſe loſt before the proper impreſſion can be made by the iron. After firing a bliſter is ſometimes applied, as this is thought to increaſe the good effect produced by the iron. When firing is employed on the hind legs, or on any part where the operator would be expoſed to danger from the horſe's kicking, it is neceſſary to confine the legs by means of fetters.

3d, This operation has been found uſeful in ſpaving, ring-bones, old callous ſwellings of the back ſinews, and in wind-galls. For this purpoſe the irons are uſed as already directed. It is the cuſtom with ſome farriers to apply a bliſter in theſe caſes before firing, in order to reduce the ſwelling; as they ſuppoſe that firing employed without this precaution would tend to fix the ſwelling, and render it incurable. There is probably little foundation for ſuch an idea.

4th, Firing is very frequently had recourſe to by way of a ſtyptic in ſtopping or checking profuſe bleedings, from accidental wounds, or ſurgical operations. The iron employed with this view has generally a rounded extremity, except in the operation of docking, where an iron in the form of a ring is generally employed.

5th. Another uſe of firing is in wounds of the joints, or other circumſcribed cavities, where it is employed to promote a kindly circulation, and conſequent granulation of healthy fleſh. It has been employed in theſe caſes by Mr Coleman, with conſiderable ſucceſs.

6th, Firing has been found one of the moſt effectual remedies in thoſe ſuperficial ulcers that accompany farcy or glanders in the horſe; and,

Laſtly, The uſe of the hot iron has been found the only certain means of preventing the dreadful effects ariſing from the bite of a mad animal, when properly applied after cutting out the bitten part.

Chap. VI. *Of Docking.*

176 Docking firſt uſed in England.

The honour of having introduced this moſt uſeful and humane practice, belongs, we believe, ſolely to this country. It appears that it was in uſe in England, ſo long ago as the end of the eighth century; for at a council held there, about that time (*concilium Calchutenſe*, or council of Calchute), there was a canon enacted, expreſsly forbidding this practice, as indecent and abominable.

It does not appear that this operation is performed among the Arabians, or other eaſtern nations; or at leaſt, if it be, it is not intended as an ornament to the animal, but either from neceſſity, when the tail is diſeaſed, or by way of mark, to diſtinguiſh ſome particular horſe.

Docking has been practiſed in Germany for about 300 years; and probably much longer in France. It was certainly unknown to the Italians at the latter end of the fifteenth century; for we are told, that when the army of the emperor Maximilian was in Italy in 1497, the Italians were much ſurpriſed to ſee his cavalry mounted on docked horſes.

177 Its abſurdity.

It is ſtrange that prejudice and falſe taſte ſhould lead mankind to deprive their horſes of a part, which, to the eye of reaſon and unſophiſticated nature, muſt appear not only an ornament to the animal, but as deſigned by the Creator as a protection againſt flies, gnats, and innumerable other winged enemies, which haraſs them in the ſummer months. It is true indeed, that in Britain, where the ſummer heats are in general not ſo laſting, or ſo violent, as in the more ſouthern countries of Europe, theſe inſects are not always ſo troubleſome as they are found in thoſe climates. But even here they are ſufficiently ſo, to render the protection of the tail neceſſary; and when our cavalry are unhappily ſent to the continent, the loſs of the horſes tails proves a very ſerious obſtacle to the ſucceſs of the troops. More than one inſtance of this has occurred. At the battle of Dettingen in 1743, great part of the Britiſh cavalry were abſolutely diſmounted, from the death of the horſes, occaſioned in a great meaſure by the torment which they experienced from the bite of gad-flies, and other inſects; and at the battle of Minden, in the ſeven years war, the cavalry of the allies were thrown into ſo much diſorder by theſe petty enemies, that they had nearly loſt the battle. Lord Pembroke declares, that he has ſeen the cavalry horſes belonging to our army, ſweating, ruſhing againſt each other, refuſing their food, and abſolutely devoured by flies, for want of their tails to bruſh them off; while thoſe of the horſes of the foreign cavalry that had not been deprived of this neceſſary defence, were cool, tranquil, fed well, and were in good condition. From the inconveniences which our cavalry have ſuffered from the want of the horſes tails, it has been for ſome years the cuſtom to employ long-tailed horſes. Operations.

The principal reaſons that have been aſſigned for this abſurd practice, are, that a long tail is extremely inconvenient to both horſe and rider, when travelling through dirty roads and buſhy foreſts; and that when the tail is of its ordinary length, the animal cannot carry it in that fine, arched, cocked-tail direction, which ſeems to form one of the chief beauties of the modern racer.

We apprehend that few horſes enjoy ſuch an ample length of tail as that of the redoubted Hudibras; of whoſe horſe we read that,

> "His draggling tail hung in the dirt,
> "Which on his rider he would flirt,
> "Still as his tender ſide he prickt
> "With arm'd heel, or with unarm'd, kickt."

As to the beauty of a cocked-tailed horſe, we profeſs ourſelves not competent to judge, but with due deference to the gentlemen of the turf, and the reſpectable fraternity of jockies, we ſhould humbly conceive (we ſpeak with ſubmiſſion) that a horſe with a long tail is a much finer object than one that is perpetually perking and wriggling his tail in the air, and expoſing his bare breech to the broad ſtare of open day.

178 Mode of performing the operation.

Docking is uſually performed on horſes, by laying the tail upon a block, and chopping off the part by means of a cleaver or hatchet ſtruck with a mallet. Perhaps it would be rather leſs bungling to perform the operation by means of a knife, and it would not take up much more time. When this is done, the hair muſt be previouſly clipped away, that the knife may cut more eaſily; and previous to making the incision, the ſkin ſhould be drawn up forcibly towards the rump. The incision may be made by beginning on one ſide, and cutting round from below upwards, ſo as to perform the whole

Operations. whole as nearly as poſſible at one ſtroke. When the ſkin and muſcles have been completed divided, the part of the tail is to be cut off at the joining of two of the bones as nearly as poſſible to the edges of the wound, ſtill keeping the ſkin drawn up. When the part has been removed, the fleſh is to be ſeared all round with a hot iron, to ſtop the effuſion of blood. The iron employed in France for this purpoſe is formed like a ring, ſo that it is eaſily applied to the fleſh without injuring the bone. The wound muſt be covered from the air, and the animal muſt live rather low to prevent inflammation.

The practice of nicking, or cutting acroſs the muſcles that draw down the tail, ſo that thoſe which pull it upwards may exert their full power, is ſtill more inhuman and abſurd than that of docking; and as we will contribute nothing towards extending this abominable practice, we ſhall omit the operation altogether.

Chap. VII. *Of Cropping.*

179
Cropping. Taste and faſhion have introduced another operation, by which the ears of horſes and dogs are changed from their natural ſhape and ſize, to thoſe which are conſidered by their owners as more handſome or agreeable. The ears of the horſe and the dog are ſeldom of ſuch a ſhape or ſize, as to render them inconvenient to the animals, or to unfit them for the purpoſes for which nature has deſigned them. This may, however, ſometimes happen; and there are ſome caſes of wounds or diſeaſes that may render cropping neceſſary: but in performing this operation, it ſhould always be kept in mind, that as no part of the animal is made in vain, no more of the ears ſhould be taken away than what is abſolutely neceſſary. We not unfrequently ſee horſes and dogs cropped cloſe to their head, a practice which is cruel and abſurd, and which is always followed by more or leſs deafneſs, and expoſes the animals to much inconvenience from the weather. In thoſe dogs that are employed in rabbit warrens, or for ſimilar purpoſes, where they are required to enter burrows, cropping is attended with the worſt effects, as the ears of the dog are unavoidably expoſed to the particles of ſand and earth that he bruſhes away in his paſſage through the burrow.

The operation of cropping ſcarcely requires deſcription. In the dog it is uſually performed by means of a pair of ſciſſars, but theſe ſhould be very ſharp. In the horſe, more nicety is required; and a particular inſtrument, called the *cropping iron*, is required, and a ſhape of the ſize of which it is intended the ear ſhall be, is applied to the ear, to mark the line of ſection. After the ear is cut, the ſkin and muſcles recede conſiderably from the griſtly part; but this ſeems of little conſequence, and the wound heals in a few days without any other attention, than confining the animal within doors, and keeping him on a moderate, cooling diet. Horſes ears are ſometimes trimmed, as the grooms call it; that is, they are deprived of the fine ſoft hair that lines the inſide of the cavity. This practice is equally abſurd with cropping, as will appear from the following obſervations of Mr Clark.

180
Abſurdity of trimming horſes ears. "The ears of horſes, as of other animals, (ſays Mr Clarke), are covered on the inſide with a ſhort down, intermixed with long hairs, which line the external cavity of the ear, which ſeems deſigned by nature to prevent harſh ſounds from making too great an impreſſion upon the brain, and likewiſe to prevent the cold air, rain, duſt, flies, &c. from annoying the internal ear. The means commonly uſed to remove this down, &c. is by the ſciſſars, the flame of a candle, or that of a burning torch. Both the latter are cruel and barbarous, and cauſe a deal of pain to the animal, not only from the bliſters that ſometimes riſe on the ears after this manner of ſinging them, but likewiſe from the means that are uſed to make horſes ſtand with patience to undergo the operation, that is a twitch on the noſe; and perhaps, if he is troubleſome to the operator, one put on the ear. It is to be obſerved, that horſes are very much guided or directed by the ſenſe of hearing. This is obvious in thoſe that hear diſtinctly, from the motion of their ears, and the direction they give them to whatever quarter any ſound comes from, the attention they pay to what paſſes around them, or to what is ſpoke to them. Many of them, particularly the fineſt kind, as they only are liable to this kind of treatment, have the ſenſe of hearing conſiderably blunted, if not rendered quite deaf from the above operation.

As this operation is generally firſt performed on young horſes at the time they are breaking, it is the more hurtful; as the uncommon ſounds, as the rattling of carriages, drums, &c. which are entirely new to them, and to which they are then more expoſed on the roads or in ſtreets, muſt make the greater impreſſion on the ſenſe of hearing; and perhaps it may be owing to the above cauſe only, that many horſes are timorous to paſs carriages, and remain ſo ever afterwards.

Another diſadvantage which attends this operation upon the ears of horſes, is, that they will not go on cheerfully when travelling in oppoſition to the wind, more eſpecially if it rains; for as the wind and rain get free acceſs into the ears, they are continually ſhaking their heads and endeavouring to turn from it; and thoſe who are of a more impatient temper, will wheel ſuddenly round, in order to avoid what gives them ſo much uneaſineſs. They are then ſaid to be reſtive; the whip and ſpurs are applied by way of chaſtiſement for a ſuppoſed fault only.

From what has been ſaid, it will be obvious, from the practice of taking away the natural covering from the inſide of the ears, that the internal ear muſt be expoſed to be conſiderably injured, particularly from cold, duſt, &c. which blunts the ſenſe of hearing, and perhaps cauſes deafneſs; for it is obſerved in thoſe horſes who have been much uſed to this treatment, that they loſe that lively, active motion of the ears, and appear dull and inattentive to what paſſes around them, and even to the voice of their keeper *.

* Clark on Preventics.

Chap. VIII. *Of Caſtration.*

181
Caſtration. It is found of uſe to deprive the males of ſeveral of the domeſtic animals, eſpecially of horſes and cattle, of the means of propagation, either to render them more mild and tractable, or, in the caſe of cattle, to promote their fattening, and render their fleſh leſs rank. It has been diſputed whether the caſtration of the ſtallion is productive of ſuch advantages as are not counterbalanced by the loſs of ſtrength and ſpirit, which the animals ſuſtain

Operations. sustain by the operation. It is not our intention to discuss this point, and we shall here only describe the usual modes of performing the operation.

182 Mode of castrating. The most prudent mode of castrating an adult or grown horse, appears to be the following. Let him be thrown on some convenient spot, on the off side, and when down, let the off hind leg be drawn towards the neck, by which the scrotum will be fairly exposed. Holding the scrotum firmly, make a cut at once through it, not of too great length, but sufficient to admit the testicle being pressed out; this being done, apply the clams or a pair of nippers on the cord within an inch of the testicle, and hold the clams sufficiently tight to stop the flow of blood, but not to bruise the cord; the stone may then be cut off with a scalpel, or it may be feared off with a burning knife. If it is cut off with a scalpel immediately before the clams let go their hold, fear the end of the cord. Some apply a little powdered resin on it before fearing, after which the clams may be loosened. When this is finished, proceed to remove the other in the same manner.

After both are removed, a pledgit of lint, wetted in warmed spirits, may be introduced just within the edges of each wound; but no salt should by any means be introduced, as is the practice of some farriers; nor will any kind of bandage be easily retained, and if any thing of this kind is used, it should be very loosely applied, so as not to irritate.

When this operation is performed on a full grown horse, if he is at all fat, he should be previously bled, and kept rather low; and it will be prudent to choose mild weather for the operation; and the place likewise he is put into after the operation, should be of a moderate temperature.

Sometimes there is a considerable degree of inflammation, and when this happens, it is by no means proper to trot the horse about as is commonly done, but to bleed and purge, and apply a solution of sugar of lead to the parts. It will also be of advantage to insert a seton smeared with blistering ointment into the inside of the thigh.

Some operators separate the epididymis from the testicle and suffer it to remain, by which means they think that a portion of the animal's spirit is retained. A similar custom is said to prevail in France; but the French operators object to it, on the idea that it produces fistulous sores in the part. The fact is, that when any portion of the testicle is suffered to remain, though it cannot secrete semen, yet it has some action going on within, by which it produces some influence both on the mind and form; and as such, the future growth of the animal may perhaps be slightly affected by it, and perhaps his temper too, but the addition to the latter may probably not be a very favourable one *.

* *Blaine's Outlines*, vol. ii.

183 Time of performing it. Where the operation is to be performed, the best time is probably when the foal is about three months old, though some prefer a much more advanced age, as six, or even 12 months, and more in some cases. In all animals there is, however, the least danger of inflammation while they are young in performing such operations. Besides it is better to cut colts before they have any propensity to hanker after mares, and get bad habits. When the foals are early, and the weather is not too hot, the latter end of May or beginning of June may be a good and proper season.

Some of the Yorkshire breeders, however, think that they find advantage in deferring the operation till the horses are two years old, as they suppose they become the stronger and handsomer for it. And where the operation is performed at one year old, they find that the foals have not recovered the check they sustained by weaning before they experience another in this operation. They experience no greater difference in their recovery at two years old than one. The foals should be kept up some time before the gelding is to be performed. * Operations.

* *Dickson Agricult.* vol. ii.

The castrating of male lambs is performed at different periods in different districts; but it seems the most proper to be done in the first fortnight in the stronger sort of lambs, and in those of the weaker kind from a fortnight to three weeks, or a month old, according to circumstances. Some, however, advise its being done at a much later period. When done early, there is, however, the least danger of too much inflammation coming on, if the lambs be in a healthy condition. When performed while very young, on tender, delicate lambs, mortification may sometimes be apt to come on and destroy them. †

† *Ibid.*

Chap. IX. *Of Spaying.*

184 Spaying. Spaying is an operation performed on the females, chiefly on cattle and dogs, to prevent their producing young. It consists in taking away the *ovaries*, or those appendages to the womb in which are formed the rudiments of the young. It is supposed that it is attended with considerable advantage, in cows or heifers, as it greatly promotes their fattening. In bitches, it is generally employed to prevent the unpleasant circumstances that often occur in the time they are in heat.

Spaying is usually performed after the animal has been newly impregnated, as at that time the ovaries are larger than before impregnation, and are of course more easily discovered. In performing the operation, a cut is made through the integuments of the belly, between the haunch-bone and the last ribs, and through this opening the fingers are to be introduced. If the animal has not been impregnated, a roundish hard substance will be felt attached to the loins. This is to be drawn out and cut off, and that on the other side is now to be felt for, drawn out, and cut away. The ovaries, as has been said, will be much more readily found, especially the inmost one, when the animal is impregnated, as the young within the horns of the womb afford a good direction to the finger. It is sometimes necessary, when the animal is not in a state of impregnation, to make an opening on each side of the belly, one for the extraction of each ovary; but when this is found requisite, it will be better to delay the second operation till the animal is in some measure recovered from the first. When the ovaries have been cut away, the openings must be closed by means of a stitch through the integuments of the belly, and must be carefully covered with sticking plaster, to prevent the admission of the external air.

185 Mr Daniel remarks, that this operation does not always succeed in bitches, unless done by a skilful person, who can be relied upon. If it be ill done, although the bitches can have no puppies, they will notwithstanding go to heat, which defeats the purpose. There is a difference of opinion, whether a bitch should be

Operations. spayed *before* or *after* she has had a litter of whelps; Mr Daniel, however, has tried, and found both periods to answer. The best time is 14 or 15 days after she has taken the dog, and when the puppies just begin to be knotted within her. All the roots of the veins should not be taken away; her strength and swiftness will be injured by so doing. They should be kept low for several days before the operation is performed, and fed on thin meat for some time after *.

* *Daniel's Rural Sports.*

Chap. X. *Of Delivery in Difficult Labours.*

186 Delivery. In general, Nature is all-sufficient for bringing forth the young of domestic animals, and man has little to do, except to take care that the females be not in such a situation as may expose themselves or their young to injury. It is proper always to watch a mare, or a cow, that is near the time of bringing forth; and to be at hand, to afford assistance where necessary. Mares do not often require assistance, as with them, difficult labour is uncommon. Where this does occur, the directions we are about to give for the cow, will in general answer for the mare.

Cows, particularly the short-horned species, often need the assistance of the accoucheur. The natural presentation of the calf, is with its head and fore-feet, the nose between the feet, and the back upwards. Downing enumerates seven preternatural positions: namely, 1st, Reverse presentation, or tail first. 2d, Fore-feet, no head appearing. 3d. Side-belly upwards, head reversed over one shoulder, legs appearing. 4th, Fore-feet, with head under the brisket. 5th, Head alone, or one fore-leg only with it. 6th, Head and one leg, or head alone. 7th, Calf lying on its back, its four legs folded nearly together, and close up to the cow's back; the head appearing, or doubled back, even with the ribs, on one side or other; one hind-leg, perhaps, appearing.

187 Directions for delivering cows in those positions. The following general rules are given by Mr Lawrence.—Timely assistance before the cow is exhausted. Extraction never to be attempted in an improper position. Supple the hand and arm with warm water and fresh lard. Examination best made, the cow standing, and in the interval of pains. In pulling at the feet, inclose the claws in the hand, that the horn may not bruise the cow. Navel string bursting, and the usual flux of blood, of no consequence. Instruments to be used only in the last resort, and by experienced and steady persons only. The proper hook is of hard iron, four inches long, with a loop for the cord at the straight end.

In a natural position, if the cow should want help, the position of the calf may be ascertained after the waters have been seen. A cord ought to be in readiness, to attach to the fore legs of the calf, in order to assist each natural exertion. The head to be kept clear of obstruction.

Preternatural position. N° 1.-as above. No attempt to turn the calf (this position being favourable for extraction), but use expedition, for fear it be suffocated. Press the haunches back with the palm of the hand, take hold of the bend of the hough of one leg, pull at it, and reach the foot; both feet may thus be brought forth. N° 2. Reduce the head to its proper situation, between the fore-legs, either by hold of the nose, or the face-bone. A long arm is needful, which must be kept Operations. to the full extent in the body, that instant advantage may be taken of every throe, the fingers being properly fixed. N° 3. Gently move the calf back, and bring the head forth to the legs. N° 4. Push the calf back to find the head; pull at the nose; this requires address, but it is useless to employ force, until the head be in its proper place. N° 5 and 6. Push the calf back against the shoulders and brisket; the feet will be found folded under the belly; bring the feet forward, one at a time, the hand being gently placed on the bend of the knee. Should the head be too much swelled and bruised, to be returned, it must be skinned and amputated. Dissect in a straight line from the poll to the nose, force the skin back over the first joint of the neck, divide the head from the body, pushing the latter back to obtain hold of the knees. The loose skin must be previously wrapped over the ragged bone, and an assistant should have fast hold, in order to guide it clear of the haunch-bones of the cow; should it hitch there, put back instantly. N° 7. If one hind-leg appear, put it back; the calf cannot be brought forth with a hinder and fore-leg together, and the difference between the knee and hough will be immediately discovered. The head being doubled back, must of course be reduced to its proper place. The cow being strong and quiet, the business may be effected with care and patience; but should the hook be positively necessary, hold must be taken, either in the sockets of the eyes, cavity of the ears, or in the jaw. The case of *dropsy* in the calf will be sufficiently apparent by its preternatural size; use the knife carefully, should that be necessary, to pierce the belly of the calf.

* *Lawrence on Horses*, vol. ii.

188 In preternatural contraction of the passage. There is a very material obstruction which frequently happens to the calving of cows. It is called a horning of the lye or calf-bed, when the passage of it is contracted into a very small circumference, insomuch, that at the full time of gestation, it will not admit so much as the smallest hand, and grows so sinewy or horned, as renders it utterly impossible for the cow to calve without assistance, and many cattle have died under this dreadful inconvenience, when it might have been easily prevented; but so little has been known hitherto of the diseases peculiar to black cattle, that many thousands have fallen victims to untimely death, that a simple remedy or operation might have saved.

In the case before observed, it must take a considerable length of time, before it is contracted, as it is often found; but no suspicion or dread can reasonably take place, until near the time when the beast has arrived at the end of nine months, her full time of bearing young: when they generally make a regular preparation, or falling of the parts of generation, for a few days, or weeks before calving; but in cases of this hornedness of the calf-bed, it is observed that they are backward in making these necessary alterations, preparatory to the approaching change; and when this is noticed, more than usual observation ought to be taken, for when they do not prepare in a regular manner, they seldom have the efforts of nature in due course, for the delivery of their burthen.—But when the beast is observed sick for calving, and has reached the end of her time, and any dread of this apprehended, there is no danger or impropriety in searching with the hand, in order to be satisfied, whether that part is open, or grown

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grown up, as previouſly deſcribed; yet the greateſt care is neceſſary, that the inquiry be made with judgment, and the hand that is introduced muſt be well lathered with ſoap and water, or greaſed with tallow, freſh butter, or ſome ſuch thing, that will not cauſe irritation in the neck of the womb.

Now, if it be found in the ſtate deſcribed in any degree, and a certainty of the beaſt being at its full time, with the common ſickneſs and ſymptoms for calving, no time ſhould be loſt until the animal be relieved. The difficulty greatly depends on knowing to what degree it is grown up; it is ſometimes ſo ſtrait as not to admit the end of a finger, but with ſome exertion, it may give ſo much way as that a ſmall knife may be introduced, whoſe blade ſhould not be above an inch and a half in length, and very ſharp, with a hollow on the back part of the point, for the end of the fore-finger to guide the knife when cutting, and to cover the point and edge, when introduced, which muſt be covered as much as poſſible with the hand. Its handle ought to be ſhort, and the fore-finger of the operator ſhould always be kept forward on the knife, to prevent any danger that might ariſe from the edge of it. The horny circle is ſometimes ſo hard and griſtly, that it takes more exertion than may have been expected from the nature of the place; but as ſoon as it is cut through, the beaſt will find a very material difference, and ſtrive to void her burden, if poſſible, when every exertion of art ought to be uſed for her relief. Many people have ſuffered the beaſt, ſo diſordered, to die a miſerable death before their eyes, without offering to render her any aſſiſtance, and ſome have attempted to take the calf out at the ſide of the animal, a practice commonly known by the name of the Cæſarean operation; but the other method is to be preferred, when the obſtruction is the reſult of hornedneſs. But operations of this kind in general fail, from neglecting the attempt until every natural hope is gone, and the patient ſo much weakened, as to die under the hands of the perſon who has undertaken the taſk. It is, therefore recommended, that no time be loſt in aſcertaining the cauſe of any delay in calving, and that every exertion be uſed, while the animal has ſtrength to undergo the operation, and to ſecond the attempt. When the buſineſs is happily over, the wounded parts within muſt be taken care of, by providing one pint of rectified ſpirit of wine camphorated, to anoint the wound, and any other parts which may have been expoſed to the air, bruiſed, or over diſtended. This may be conveyed up the neck of the womb by a ſyringe, ſponge, or linen rag filled with it, and carried thither by a ſmall hand, well fomented with ſome of the foregoing articles for that purpoſe. Let the beaſt be kept moderately warm, and in a comfortable ſituation, allowing her at all times a plentiful ſupply of good, dry, and ſweet litter. We have taken the above from Rowlin's Complete Cow-doctor.

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PART IV. HYGEIOLOGY; OR, THE MEANS OF PRESERVING THE HEALTH OF DOMESTIC ANIMALS.

189 BEFORE we enter on the conſideration of the diſeaſes, that affect domeſtic animals, whoſe medical treatment is to form the ſubject of the remaining part of this article; it will be proper to lay down ſome inſtructions for the management of theſe animals in a ſtate of health, with a view to that moſt important object, the avoiding of the cauſes of diſeaſe. The preſervation of health muſt ever be conſidered as one of the principal objects of the medical practitioner, and has exerciſed the pens of ſome of the moſt eminent phyſicians in all ages. But the conſideration of this ſubject is ſtill more neceſſary in the treatment of the inferior animals, than in that of man. In the former the cure of diſeaſe is rendered much more difficult and precarious, on account of the obſcurity in which the ſymptoms are often hid, and the difficulty which we frequently experience in inveſtigating the cauſes of morbid affections.

190 Habitations. The management of domeſtic animals in a ſtate of health, chiefly reſpects the habitations in which they are placed, when taken from their native fields; their food and drink; cleanlineſs, and exerciſe.

CHAP. I. *Of Stables, Cow-houſes, and Kennels.*

IN a ſtate of nature, all the animals at preſent under our conſideration, are conſtantly expoſed to the open air, and only ſeek for ſhelter from the inclemencies of the weather under woods and thickets. The young of all theſe animals when domeſticated, except the dog, are for a long time left in a ſimilar ſtate, till, for the convenience of their maſters, it is found neceſſary to place them in habitations. The ſtructure of theſe, that is of ſtables, cowhouſes, and kennels, and the method of treating the animals confined in them, is of the utmoſt conſequence; as on theſe the animals health and comfort muſt in a great meaſure depend.

1. *Of Stables.*

191 Should be built on a dry and elevated place. Stables ſhould be built on a dry ſoil, that is ſomewhat elevated; or, at leaſt, they muſt not be built in a hollow, or in the neighbourhood of boggy or marſhy land: The damp cold air, ariſing from moiſt, low ſituations, is extremely prejudicial to the health of all animals, particularly horſes, and, as we ſhall ſee hereafter, to ſheep. It renders them ſubject to colds, rheumatiſm, and not unfrequently to fever. Stables built in theſe ſituations are therefore always dangerous; and more particularly ſo, when the animals return to them after having been heated by violent exerciſe or labour.

192 Should be roomy. Stables ſhould be roomy in proportion to the number of horſes that it is propoſed they ſhould contain. Perhaps no ſtable ſhould be made to hold more than five or ſix horſes, as many inconveniences ariſe from keeping too many of theſe animals in the ſame apartment. Not only is the air thereby much more vitiated, but the reſt and ſleep, ſo neceſſary to repair the fatigues of the day, are thus prevented or diſturbed. Some horſes will not ſleep, or even lie down, if not perfectly at their eaſe; and hence, in large ſtables, that are made to contain a dozen or more horſes, as is often the caſe in livery ſta-

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bles, and ſuch as are attached to large inns, the frequent entrance of grooms, oſtlers, and other perſons with lights, into the ſtable, and even the reſtleſs noiſe of ſome of the horſes, who are more watchful, or have been leſs fatigued than others, muſt be a great diſturbance to theſe latter. Where neceſſity requires a long range of ſtables, it is better to have them divided, by thick partition walls, into ſeparate apartments, each made to contain not more than ſix horſes. The additional expence of this would be trifling, compared to the greater eaſe and comfort of the animals.

It is uſual in large ſtables, for the ſake of keeping more horſes conveniently under the ſame roof, to make them double-headed, as it is termed; that is, to have a range of ſtalls along each wall, with a ſpace between, for perſons to paſs to and fro. Stables of this kind are very improper; the ſpace between the two ranges is often ſo narrow, that when the oppoſite ſtalls are occupied at the ſame time, the horſes can reach each other with their hind feet, eſpecially when ſtanding, as they often do, at the full length of their halter. Hence, in the conteſts that often ariſe between quarrelſome or mettleſome horſes, very ſevere bruiſes, and even lameneſs, are not unuſually the conſequences of the animals being within each others reach. The danger that threatens paſſengers in theſe narrow ſpaces is alſo not ſmall; we have often trembled, when obliged to paſs between two rows of horſes, kicking and wincing under the curry-combs, where the intermediate ſpace did not exceed three or four feet. If double-headed ſtables muſt be uſed, the ſpace between the ranges of ſtalls ſhould be at leaſt eight feet.

193 Double ſtables improper.

194 Roof ſhould not be low.

The roof of ſtables ſhould not be low; for, as the foul and vitiated air, generated by reſpiration and the exhalations of animal bodies, naturally aſcends to the higheſt parts, the horſes, who uſually carry their heads very high, are, when the ceiling of the ſtable is low, fully expoſed to the noxious influence of this vitiated atmoſphere. This is not the place to enlarge on the vitiation that the air undergoes from the action of the animals that are confined in it; this ſubject has been already fully conſidered in the article CHEMISTRY when ſpeaking of *reſpiration*; and, from what has been there delivered, the reader will ſee the neceſſity of pure air to horſes and other animals as well as man, and will be able to judge of the propriety of the above maxim, and ſome others which we ſhall preſently lay down.

The walls of the ſtable ſhould be of ſtone or brick, and by no means of wood; they ſhould alſo be leſt bare, or at leaſt only covered with plaiſter. The temperature of the air, in buildings of ſtone or brick, is much more equable than in thoſe built of wood, they are not ſo eaſily penetrated by the heat of ſummer, or the cold of winter, and they are alſo attended with another important advantage, that they reſiſt the ſpreading of fire.

195 Stalls.

The ſtalls in which the horſes are to ſtand ſhould be divided from each other by ſtrong wooden partitions, that ſhould riſe ſufficiently high to prevent the horſe from ſtepping over, but not ſo high as to impede the free circulation of air, and admiſſion of light from one ſtall to another. The breadth of each ſtall ſhould be ſuch as will freely admit of the horſe turning himſelf, and ſtretching at his full length when he lies down; but they ſhould not be ſo wide as to allow of his kicking againſt the partition. The floor of the ſtall ſhould have a gentle declivity, from the manger backwards. This allows the urine and water to run eaſily off; it alſo relieves the fore quarters of the horſe, and adds much to the grace of his appearance behind. Too great a ſlope, however, muſt be avoided, as when the declivity is too rapid, all the weight of the horſe is thrown on his hind legs; and, as it is extremely uneaſy for the animal to remain long in this poſition, he is obliged to preſs his body forward, which he cannot accompliſh, without keeping the hind legs always on the ſtretch; the paſtern-joint, from its ſituation, receives the whole additional weight, and the ligament which connects it is invariably ſtrained in all horſes which are kept in this ſort of ſtable for any length of time.

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A ſlope of one inch in ſix feet will be ſufficient to anſwer every purpoſe.

This declivity ſhould terminate in a hollow ſpace a few inches from the end of the ſtall, forming a ſort of gutter, extending the whole length of the ſtable, and paſſing out through the wall at each end, where iron bars ſhould be placed, to admit of the water, &c. paſſing out of the ſtable, which is the intention of this gutter, but preventing the intruſion of rats, and other noxious animals.

196 Floor.

The floor of ſtables is commonly paved with ſtone, or hard bricks made for that purpoſe. This kind of flooring has the advantage of being more durable than any other; but it is not without its inconveniencies. The ſtones or bricks become ſmooth by wearing, and, when the ſtable is wet, the horſe, eſpecially if he be very friſky, is apt to ſlip, and endanger ſtraining or otherways injuring his limbs. Again, by the pawing, or ſtamping, to which theſe animals are often ſubject, the pavement may be looſened or broken. For theſe reaſons, it would perhaps be better that at leaſt the ſtalls ſhould be floored with ſtrong oaken planks well ſeaſoned, and laid acroſs the ſtall, with their extremities below the partitions, and having their joining edges accurately adapted to each other. A flooring of this kind has the advantage of being more elaſtic, and of preſerving a more equable temperature than pavement; and it is not liable to the inconveniencies which we have mentioned, as attending this latter. A wooden flooring is indeed expenſive, but this is more than counterbalanced by the advantages to the horſe. It is of little conſequence how the reſt of the ſtable is covered; ſome gentlemen floor their ſtables with a ſort of cement, which in courſe of time becomes as hard as ſtone, and has the advantage of being perfectly ſmooth and even. The gutter ſhould of courſe be well paved.

197 Manger.

The manger for receiving the horſes corn ſhould be about a foot broad, and five or ſix inches deep. The manger is uſually made of wood, and when this is the caſe, the boards compoſing it ſhould be ſo cloſely joined, that the corn cannot get through between them. The front of the manger ſhould riſe about three feet, or a little more, from the ground; ſhould ſlope a little, and ſhould terminate above by a ſtrong rounded border. This, if the manger be made of wood, ſhould be covered with tin plate, or white iron, as horſes are very apt, when without food, or when allowed to remain long in the ſtall, to bite the front of the manger, and thus acquire a very bad habit, which farriers call *cribbiting*. Some chuſe to make the manger of ſtone, which

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which has the advantage of wood in being more durable and cleanly, wood acquiring by uſe an unpleaſant ſmell, and being ſoon rotted by the moiſture of the food, which it often receives. The bottom of the manger ſhould ſlope a little forwards.

The manger is ſometimes made to extend the whole length of the ſtable, when it is in general divided into ſeveral cavities, one for each horſe. It is of little conſequence whether it be one continued cavity, or whether there be a ſeparate manger for each ſtall; but the manger ſhould by no means be ſupported on legs, ſo as to make it moveable, as is ſometimes done; as this prevents the litter from being conveniently ſtowed below the manger, and expoſes the horſe or the manger to accidents. It ſhould therefore be firmly fixed at the back to the wall of the ſtable, and to each partition of the ſtall. Sometimes a hollow is made at one end of the manger, or at one end of each diviſion of it, for the purpoſe of holding water. When this is done, there ſhould be a hole in the bottom of this cavity fitted with a plug, to draw off the water when the horſe has done drinking, or when the manger has been waſhed.

In the middle of the front of the manger, in its thick edge, there is uſually fixed an iron ring, turning eaſily in an eye bolt, for the purpoſe of paſſing through the halter, by which the horſe is faſtened. Sometimes, inſtead of this ring, a hole is made through the border of the manger for the halter to paſs through; but as the halter does not ſlip backwards and forwards eaſily through ſuch a hole, and wears very faſt by rubbing againſt the wood, the iron ring is to be preferred. The horſe ſhould always be faſtened in ſuch a way, as that the halter ſhall ſlide backwards and forwards with every motion of the horſe's head; and he ſhould on no account be tied by the halter, as this expoſes him to accidents, by twiſting the halter about his neck or legs.

198 Rack.

The rack ſhould be placed at ſuch a height above the manger, as that the horſe can eaſily reach it, to pull out the hay; it ſhould be very ſtrong and firmly fixed, and ſhould incline a little outwards from the wall of the ſtable. The bars of which it is compoſed, ſhould not be above four or five inches aſunder, that the hay may not fall out and be waſted.

One circumſtance particularly to be attended to in the conſtruction of ſtables is, to preſerve a free circulation of air.

199 Stables ſhould not be too cloſe.

The generality of ſtables are by much too cloſe and warm; not a chink is left for the free admiſſion of air; the door, and windows (if there are any), are made ſo cloſe, as perfectly to exclude the air; or, if this is not the caſe, the crevices are frequently ſtopped with hay, under the idea that the horſes cannot be kept too warm. This is a moſt abſurd and miſtaken notion; and is contradicted both by reaſon and daily experience. When we conſider that horſes in a ſtate of nature, or even in their uſual paſtures, are perpetually expoſed to the open air, and that, under theſe circumſtances, they are more vigorous and active than under the moſt attentive care of their maſters, we muſt be convinced of the impropriety of keeping them for hours together in the foul and heated atmoſphere of the ordinary cloſe ſtables. Whoever enters one of theſe ſtables when the door is firſt opened in the morning, after it has been cloſely ſhut up all night, will be able to judge from his own ſenſations, whether ſuch an atmoſphere can be wholeſome to the animals that breathe it. Beſides the great heat of the ſtable, which, if many horſes have been ſhut up in it all night is nearly intolerable, the air will be found highly impure from the continued reſpiration of ſo many animals, and the ſteams ariſing from the exhalations of their bodies, which have probably ſweated profuſely from having been ſo long confined in an atmoſphere ſo foul and heated. Add to this the impregnation of the air by the effluvia ariſing from the litter, &c; and it is not eaſy to conceive a more unhealthy ſituation for an animal, who, to perform the offices required of him with activity and vigour, ſhould be in the full poſſeſſion of all his ſtrength. Now it may eaſily be ſuppoſed, that ſuch an air as we have deſcribed, cannot be calculated to ſtrengthen the body of the horſes. On the contrary, it muſt be in a high degree weakening and relaxing. In this relaxed ſtate, the horſe is probably taken out immediately into the open air, whatever may be the ſeaſon or weather, and made to enter on his daily taſk. The effect which ſuch a ſudden change muſt have on the conſtitution of the ſtrongeſt horſe, need not be deſcribed. The ſudden action of the cold and probably moiſt air on a body that has been expoſed for ſo many hours to the heated air of the ſtable, muſt be productive of the worſt conſequences to the health and vigour of the animal. Accordingly, fevers, colds, rheumatiſm, aſthma, and a number of other formidable diſeaſes, may be traced to this debilitating ſource.

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We ſhould think, that the analogy of nature would have taught men to avoid ſuch abſurdities. We learn from thoſe authors who have written on the natural hiſtory of the horſe, that the Arabians, who live in tents, and are extremely careful in the management of their horſes, allow them to ſtand all day, when not employed, at the door of the tent; and at night bring them within the tent, where they lie down in the ſame apartment with their maſter and family, ſheltered indeed from the dews of the night, but freely expoſed to the circulation of air that muſt conſtantly prevail in theſe temporary dwellings.

200 Mode of ventilation.

To avoid the inconveniences ariſing from confined air, the ſtable ſhould be made high and roomy; the door and windows ſhould not be made too cloſe; and the ſtable ſhould be provided with proper ventilators. Perhaps a good method of preſerving a free circulation of air in the ſtable at all times, would be to carry up a flue diagonally through the wall at each extremity, terminating above in a ſort of chimney; and below, within the ſtable, in an opening ſufficiently wide in any part of the wall that is not immediately within the ſtall.

201 Windows.

The free admiſſion of light into ſtables is nearly of as much conſequence as that of air. It is a very erroneous opinion which is maintained by ſome grooms and ſtable-keepers, that horſes feed beſt in the dark. Theſe animals naturally love the light, and are much more cheerful and ſpirited in ſtables where this is freely admitted, than in the dark and diſmal hovels that we ſometimes find attached to inns and farm houſes. There is one bad conſequence that follows keeping horſes in a dark ſtable, which does not appear to be ſufficiently attended to. By being kept ſo long excluded from the light, the horſes eyes become weak, and unable to ſupport the full glare of open day. The pupils being ſo long

Hygeiology long habituated to an unuſual degree of dilatation, do not readily contract when the animal is brought out into the open air; hence his eyes being offended with the ſtrong light, to which he is ſo little accuſtomed, are perpetually winking and watering; the horſe appears as if half blind, and ſtarts and ſtumbles at almoſt every ſtep.

The ſtable ſhould, therefore, be furniſhed with glazed windows, in number proportioned to the ſize of the building. In general, no ſtables ſhould have fewer than two windows; and they ſhould be placed in ſuch a ſituation, as that the horſes may not receive the rays of light too directly on their eyes. Where the ſtable has only one range of ſtalls, this point can be eaſily effected, and in ſuch ſtables, the windows ſhould always be placed at the back of the horſes. But in double ſtables it is not eaſy to place the windows ſo as not to incommode ſome of the horſes, ſince, on whichever ſide of the ſtable they are made, the horſes on that ſide are expoſed to the full glare of the light; another argument againſt double ſtables. The windows ſhould by all means be ſaſhed; and ſhould be made to draw down from the top, as well as to be thrown up from below. They ſhould not be made too ſmall, and ſhould be carried up as near the ceiling of the ſtable, as is compatible with the ſtrength and ſymmetry of the building. Windows conſtructed in this way not only add much to the appearance of the ſtables and to the comfort of the horſes; but they afford one of the beſt means of promoting a free circulation of freſh air through the ſtable. For by throwing one of them up, and drawing another down, the ventilation becomes nearly as complete as poſſible.

Nothing has aſtoniſhed us more, when viewing the handſome offices attached to ſome of the gentlemen's houſes in this country, than to ſee the deficiency of the ſtables in the article of windows. When viewing them from without, we have congratulated the animals confined in them on the comfort of light and air, which they muſt enjoy from the fine ſaſh-windows, which we ſaw on each ſide of the ſtable door. How great has been our aſtoniſhment on entering the building, to find all gloomy and dark within; and that the fine ſaſh-windows which we thought we had ſeen at a diſtance, were nothing but efforts of the painter to deceive our ſenſes, and to preſent an appearance of what certainly ought to have been a reality!

We muſt be permitted here to draw what we hope will not be conſidered as an invidious compariſon between the Scotch and Engliſh method of lodging their horſes. In England we have rarely ſeen ſuch miſerable hovels as, in many parts of Scotland, are uſed to ſupply the place of ſtables. We have indeed in the former country ſeen the ſtables ſometimes very ſmall, or even conſiſting of a thatched building not very well defended from the weather; but they are for the moſt part tolerably well ventilated, and we believe ſcarcely ever without windows.

201 Lofts above the ſtable improper.

It is a common practice to build ſtables of two ſtories, the upper ſtory forming a loft for the purpoſe of keeping the horſe's hay and corn; and in gentlemen's ſtables, where the building is ſufficiently large, it is uſual to have apartments on the upper ſtory for the grooms and other ſervants employed about the ſtables to ſleep in.

The apartment employed as a hay loft has uſually a vacancy in that part of the flooring which is immediately over the rack, for the purpoſe of more conveniently ſupplying the horſes with hay. This mode of building ſtables has its convenience in an economical point of view, and theſe apartments in the upper ſtory add much to the ſhowy appearance of the building; but there are ſeveral material objections to this conſtruction. Hygeiology

1. The hay and corn being kept immediately over the ſtable, are conſtantly expoſed to the foul and heated air and putrid ſteams riſing up from the ſtalls through the rack, and are thus rendered liable to be heated and mildewed; while the duſt riſing from the ſhaking of the hay into the rack is very prejudicial to the lungs of the horſes. On this account it is much better, where this can be conveniently done, to keep the hay and corn in ſome place diſtinct from the ſtable, and bring from time to time a ſufficient quantity of hay nearly to fill the rack, into which it might be put while the horſe is abroad.

2. Another ſerious objection to having lofts and chambers above the ſtable, is that the building is thus much more expoſed to accidents from fire, owing to the careleſſneſs of the ſervants. And,

3. Theſe apartments above the ſtable render the latter much too cloſe and warm.

Where, from convenience or fancy, a gentleman chooſes to build his ſtables in the manner which we have juſt deſcribed, it will be adviſable to have the flooring above the ſtable made as cloſe as poſſible, and covered with thin bricks or ſtones for the purpoſe of checking the progreſs of fire; and for preſerving the hay and corn as much as may be from the ſteams of the ſtable, a partition wall may be raiſed from the extremity of the flooring immediately over the rack all the way to the roof of the loft, with a door opening over the rack in each ſtall. The entrance to the hay loft or chambers above the ſtable ſhould be without, and by no means, as is generally the caſe, by a trap door and ladder within the ſtable. If, as we frequently ſee in gentlemen's offices, the ſtables are built on each ſide of the coach-houſe, the entrance to the rooms above may be conveniently made by a ſtair from the coach-houſe.

The building of which the ſtable forms a part, ſhould be as much as poſſible detached from other buildings, ſo as to admit of a free circulation of air all around.

202 Stable ſhould be apart from the dung-hill.

It is a vile practice which is common on many farms and in ſome inns, to have the dung-hill or midden, cloſe to the ſtable. This nuiſance ſhould be removed as far as poſſible from the door and windows of the ſtable, as the heat and noiſome vapours ariſing from the fermenting dung impregnate the air to a conſiderable extent.

203 Neceſſity of cleanlineſs.

It is of great conſequence that the ſtable be kept ſweeped and clean. It ſhould therefore be regularly ſwept every morning, and every part of the litter that is wet and dirty ſhould be removed to the dunghill, while what is clean and dry ſhould be put up cloſe below the manger, unleſs where the horſe is lame, or has any affection of the feet or limbs, which renders it neceſſary for him to ſtand upon ſoft litter. Where the horſe is perfectly healthy, no litter ſhould be allowed in the day time, much leſs ſhould the ſtall be crammed with litter, as is often done, and is ſuffered to remain in this ſituation for many days, for the purpoſe of increaſing the quantity of manure. Nothing injures the feet

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feet of horſes more, or more frequently produces ſoftneſs of the hoof, canker, and greaſy heels, than allowing them to ſtand night and day on hot, fermenting dung. It is alſo impoſſible for the horſe to lie down in comfort in ſuch a hot-bed; and if the poor animal is obliged to recline himſelf for a time, he is ſoon compelled to riſe again, and repeatedly making the ſame attempt at reſt, and finding it impracticable, he is forced at length to ſtand altogether, perhaps ſhifting his legs from one part of the ſtall to another, to avoid the heat of the dung.

Lord Pembroke is of opinion that after working, and at night of courſe, as alſo in lamenefſes and ſickneſſes, it is good for horſes to ſtand on litter; it alſo promotes ſtaling, &c. At other times it is a bad cuſtom; the conſtant uſe of it heats and makes the feet tender, and cauſes ſwelled legs. Moreover it renders the animal delicate. Swelled legs may frequently be reduced to their proper natural ſize, by taking away the litter only, which, in ſome ſtables, where ignorant grooms and farriers govern would be a great ſaving of phyſic and bleeding, beſides ſtraw. "I have ſeen, (ſays he), by repeated experiments, legs ſwell and unſwell, by leaving litter, or taking it away, like mercury in a weather-glaſs."

204 Clothing.

It is a very common practice to keep horſes, while in the ſtable, covered up with warm cloathing. This is in ſome caſes neceſſary, eſpecially when they are under a courſe of phyſic, or are otherwiſe ſo delicate, as that they would be liable to injury from too much expoſure to the air. But its indiſcriminate uſe is highly improper, as it tends to render the horſe too delicate, and expoſes him to the danger of catching cold whenever he goes out into the air. While a horſe is in complete health, and ſtands idle, he requires very little, if any covering, unleſs the ſtable be extremely cold, or ill ſheltered. When indeed he comes into the ſtable, much heated by violent exerciſe or hard labour, it may be proper to throw over him a ſingle cloth, that he may cool gradually. Some grooms think it neceſſary, beſides enveloping the horſe with body clothes, to gird them faſt round his belly with tight rollers; and this is done with the view of taking up the horſe's belly, as they term it. The practice is exceedingly abſurd, for theſe tight rollers impede the circulation in the ſuperficial veins, produce difficult breathing, and if they be applied, as is often the caſe, after eating, they greatly obſtruct digeſtion.

To finiſh the ſubject of ſtable economy, we have only to make a few remarks on currying, or dreſſing horſes.

205 Dreſſing.

Friction employed on the horſe's ſkin is not only neceſſary to keep him clean, and to promote the inſenſible perſpiration, by freeing the ſkin and hair from impurities, but it is exceedingly uſeful when conſidered as a kind of exerciſe. It promotes the free circulation of the blood, which is much impeded by the horſe ſtanding long idle in the ſtable; and it much improves the appearance of the horſe's coat. Horſes ſhould therefore be regularly dreſſed, at leaſt twice a-day.

There are, however, ſome caſes in which general friction ought not to be employed; ſuch are caſes of internal inflammation, eſpecially of the bowels; or when there is a diſcharge of ſharp ichorous matter from any part, eſpecially the legs and heels. In theſe caſes the affected parts ſhould not be rubbed, as it would tend to increaſe the pain and diſtreſs ariſing from the inflammation. Hygeiology

2. *Of Cow-houſes, or Byres.*

206 Cow-houſes, or byres.

After what we have ſaid on the conſtruction of ſtables, we need not here enlarge on that of cow-houſes or cattle byres, as theſe buildings, ſo far at leaſt as reſpects their outſides, are conſtructed on ſimilar principles. We ſhall take occaſion, when treating on the manner of feeding cattle, to deſcribe a byre that appears to us to afford a good model for buildings of this kind.

It is of material importance in the wintering of young ſtock, to keep them more warm, and ſheltered from wet, than is uſually done, as by this means they thrive faſter, with a leſs conſumption of food, than in the contrary circumſtances. This may be effected, either by tying them up in ſtalls, in houſes for the purpoſe, or by keeping them in good ſheds in well incloſed yards.

207 Propriety of tying cattle.

The queſtion of feeding the cattle tied up, or looſe in the yards, in winter, has not been yet decided. Each method has probably advantages. In the firſt, the cattle thrive better than when left at liberty to run about the yards. Mr Marſhall found that in Yorkſhire, cattle kept tied up, and regularly fed with ſtraw in a moderate proportion, did better than in the ſouthern parts of the iſland, where left looſe in the midſt of greater plenty. Whether this effect is to be aſcribed to the greater warmth, the reſting better, or the being fed more regularly, *and eating with an appetite*, he cannot determine. Some experiments of Mr Young's alſo lead to the concluſion that cattle ſtock thrive better when tied up. They likewiſe ſhow that the practice of tying up is the only one that can be had recourſe to, where ſtraw is not in great plenty, and the quantity of the ſtock very inadequate to its conſumption.

In the latter method there is the advantage of a large ſupply of manure, eſpecially where the farmer has the convenience of litter. Where however the farmer has convenience, the former method is probably in general the moſt beneficial. In either mode of management much attention is neceſſary to keeping the ſtock conſtantly ſupplied in an evenly proportioned manner, as in this way there will be great advantage, both in the ſaving of food, and the condition of the animals.*

* *Dickſon's Agricult.* vol. ii.

208 Ox-houſes.

The neceſſity of providing ſhelter for cattle in bad weather, is now we believe pretty well underſtood by every intelligent farmer; and experience has proved that proper buildings erected for winter feeding are attended with conſiderable advantages. The erection for this purpoſe at Haſod in Wales, the reſidence of Thomas Johnes, Eſq. M. P. for the county of Cardigan, and one of the moſt eminent improvers of the preſent time, ſeem to be calculated upon a moderate ſcale. The whole length of the building is fifty feet, the roof ſhelving, its chief height being fourteen feet, the lower extremities, one ſeven and a half, the other ſix feet. A ſtone wall running up to the ſummit, parts the feeding-houſe from the other and ſmaller apartment, which is a receptacle for dung. Width of the feeding-houſe, nineteen feet within-ſide. Stalls each twelve feet long by four feet two inches wide. Gangway three feet and a half, at the heels and tails of the cattle, leading from the doors, the firſt door being for the cattle, the other

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for the attendants. Similar doors at the oppoſite ends of the building. Running water in troughs, with racks, and mangers. The cattle lie on wooden platforms, perforated for the paſſage of the urine. The urine runs, and the dung is puſhed through apertures in the wall, each of which is two feet ſquare, and one between every two ſtalls. There are 12 wooden ſlaps or windows to give light and air, to each ſtall. The dung pit is about twelve feet wide, ſunk ſome feet deep in the earth, extending the whole length of the building. The walls are built partly with ſtone, and in part with wood, the roof with larch wood, as an experiment of its durability in that expoſure.

According to Mr Lawrence, the round or quadrangular form might perhaps, either of them, be more economical as to ſpace and materials for a building to contain a conſiderable number. The oxen would moſt conveniently ſtand around with their tails toward the wall, contrary to the uſual practice, for the more eaſy throwing out the dung from a gangway, through apertures purpoſely made in the wall, into a pit, under cover, ſunk around the building. The area within would, of courſe, be for feeding, and every neceſſary purpoſe of attendance. A ſtore-chamber above completes the building, the chief objection to the form of which, is the greater expence attendant upon the reverſed poſition of the cattle, which perhaps is compenſated by the great ſaving of labour, in the more eaſily getting rid of the dung. The gangway will in courſe be ſufficiently wide to admit the beaſts to and from their ſtalls; the dung aperture in the wall may be cloſed in cold weather." *

* *Lawrence on Cattle.*

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Sheep-cots.

Of all domeſtic animals, ſheep are the moſt expoſed to the inclemencies of the weather. This ariſes chiefly from their numbers, which renders complete ſhelter very difficult; but even in the caſe of a ſmall flock, the prejudices of many feeders have prevented their procuring proper ſhelter for their ſheep, under the idea that it would render them too lazy to provide for themſelves. Theſe prejudices, however, are gradually wearing away, and few ſheep-farms are at preſent unprovided with ſhelter, either of trees or buildings. Mr Findlater, in his able ſurvey of Peebles, ſtrongly recommends ſhelter for ſheep. "It would be (ſays this gentleman) for the intereſt of every proprietor of ſheep farms, to encourage the farmer to rear ſhelter of trees, by allowing him the weedings of the plantation, and becoming bound to pay the farmer, at the rate of perhaps eight-pence or ten-pence a piece, for every tree left ſtanding at ſpecified diſtances, at the expiry of his leaſe; ſuch an intereſt communicated to the farmer, would give the moſt effectual ſecurity for the protection of the trees. Shelters are alſo procured by buildings, encloſing a ſquare open area in the middle, furniſhed with ſhades, on every ſide. *Stells* (that is circular ſpaces of area, proportioned to the ſize of the flock, encloſed by a five or ſix feet wall of ſtone, or ſod, without any roof) were the primeval ſhelters invented by our forefathers. The circular figure of the building cauſes the drifting wind in ſnow ſtorms to wheel round it, without riſing over it, and depoſiting the ſnow in the calm region within. The ſheep are fed, in winter ſtorms, with ſuch proviſion as can be procured, under the trees, in the ſheds, and within the circles. Even where no feeding is adminiſtered, much advantage reſults to the animals, from mere defence againſt the weather; and they are much the more alert in ſearching for natural food, ſo ſoon as the ſtorm ceaſes. The mode of acting of the ſheep gives a pretty certain indication of the weather to be expected: Upon the near approach of a ſtorm, thoſe accuſtomed to ſhelters are obſerved to make for their ſhelters. Upon the near approach of thaw, their preſentiment leads them to be leſs induſtrious in digging the ſnow for food, as if conſcious that ſuch labour was no longer neceſſary." *

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* *Findlater's Survey,* p. 154.

According to Mordaunt, who wrote about the middle of laſt century, ſheep pens and houſes, were then not uncommon in Eſſex and Glouceſterſhire. He directs the pens to be made at ſome convenient corner of a paſture, or where ſeveral fields, commons, or paſtures meet, ſo as to be common to them all. They ſhould alſo be erected on a dry ſpot of ground, and ſtones laid at the bottom to keep the ſheep dry and clean, whilſt under examination. The pens to be divided into partitions to hold about forty ſheep.

"The *ſheep-houſes*, for warmth in the winter ſeaſon, are made low, and a third part longer than broad, and rather large, the ſides lined with furze or boards, for warmth; the bottom laid with large ſtone ſlabs, and very level, that the urine run not away, but ſoak into the litter. It would be proper to have the ſunny ſide well lined with moveable hurdles, that when the ſun ſhines it may be laid open to give the ſheep a refreſhment, by letting them into ſome cloſe or croft, wherein the ſheep-houſe ſtands: the houſe to be well covered."

3. *Of Dog-kennels.*

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Dog-kennels.

It is uſually recommended to erect a particular building, for the ſole purpoſe of a kennel; and certainly where the proprietor's fortune will admit of it, ſuch an appropriate building is to be preferred. A common barn has, however, often been employed as a kennel; and Mr Daniel ſays, that the excellence of the hounds kept in ſuch a building has been rivalled by few that were lodged in the moſt ſumptuous edifices.

Whatever may be the form or original intention of the building, *cleanlineſs* is abſolutely neceſſary, both to the noſe of the hound and the preſervation of his health. The ſenſe of *ſmelling* is ſo exquiſite in a hound, that every ſtench muſt be ſuppoſed injurious to it; upon that *faculty* all our hopes depend, and noſtrils clogged with the effluvia of a dirty kennel, are ill adapted to carry the ſcent over greaſy fallows, or guide one through the ſoil of deer, or over ground tainted by ſheep. Dogs are by nature cleanly; where they lie, if they can avoid it, they ſeldom dung. Air and freſh ſtraw are eſſential to preſerve them healthy. They are ſubject to the *mange*; naſtineſs very much contributes to this, and although at the firſt appearance it may be eaſily checked the remedies that are uſed are in themſelves ſtrong in their operation, and will do no good to the hounds conſtitution. Let the *cleanlineſs* of the kennel, therefore, be carefully attended to; a reſort to theſe remedies will then be unneceſſary, and all injury to hounds from this ſource will be prevented.

On the preſumption that a kennel is to be erected, its ſite is ſtrongly pointed out by Somerville.

"Upon

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" Upon ſome little eminence erect
" And fronting to the ruddy dawn, its courts
" On either hand wide opening to receive
" The ſun's all-chearing beams, when mild he ſhines
" And gilds the mountains tops."

But this ſelection of a high ſituation is incompatible with a running brook; and as theſe two advantages cannot be united, water is to be preferred, with the aſpect to the *morning ſun* as much attended to as poſſible.

The number of its inmates muſt determine the ſize of the kennel; and the architecture ſhould be neat, without being uſeleſsly expenſive. The moſt magnificent is the duke of Richmond's at Goodwood, which coſt 19,000l. and is ſufficiently extenſive for two packs of hounds. The building compriſes five kennels, two 36 by 15, three 30 by 15, and two feeding rooms 20 by 15 feet, with ſtoves to warm the air, when too cold. The huntſman and whipper-in have each a parlour, kitchen, and ſleeping-room.

211 Duke of Richmond's kennel.

The nearer to the houſe the kennel is placed the better. There are reaſons againſt its too cloſe approach, but they yield to others which forbid a great diſtance. To mention one, derived indeed from a vulgar ſaying, " that the maſter's eye makes the horſe fat;" recollect that the inſpection of the kennel, is even more needful than that of the ſtable; for in both, cleanlineſs is no leſs eſſential than food.

212 Size.

The kennel ſhould be of ſufficient dimenſions at its firſt building; room for two kennels ſhould be under the ſame roof; when there is but one, it is ſeldom ſweet; and when waſhed out, the hounds, particularly in winter, not only ſuffer during the time of cleaning, but as long afterwards as it remains wet. The ſecond kennel affords opportunity for drafting the hounds intended to hunt the next morning. In a few days they will be drafted with little trouble, will readily anſwer to their names; and with equal eaſe as a ſhepherd numbers his ſheep, you may count your hounds into the hunting kennel.

213

In a morning, upon the feeder's firſt entering the kennel, he ſhould let the hounds into the outer court; the door of the hunting kennel, when not occupied by the drafted hounds for that day's hunting, ſhould be opened in bad weather to ſhelter them; the lodging-room ſhould then be thoroughly cleaned, the windows and doors opened, the litter well ſhaken, and the kennel made ſweet, before the hounds are again ſhut into it. Every omiſſion prejudicial to the hounds ſhould be immediately pointed out to the feeder, who muſt be made to remedy it; and alſo obſerve that the *great court and the other kennels* are equally objects of his attention.

214 Lodging-room.

The lodging-room ſhould be bricked, and ſloped on both ſides to the centre, where ſhould be a gutter to carry off the water, that when waſhed, the floor may be equally dried: but flag-ſtones, or large ſquare bricks termed *pammonds*, are far preferable; there are fewer interſtices, and conſequently leſs filth or water can there accumulate, and the ſurface is ſooner dry. Let the floor be kept in thorough repair, that no water may remain in any cavity, until the maſon can be had, when at any time wanted; let the ſtagnant water be carefully ſtopped up; for nothing is more hurtful to hounds, than *damp*, or more refreſhing than *warmth* after hard work. Hygeiology

215 Doors.

The kennel ſhould have three doors; two in front and one behind; that in the back to have a lattice window in it, with a wooden ſhutter, which is to be kept always cloſed, except in ſummer, when it ſhould be left open the whole of the day. This door has a two-fold utility, it ſerves to carry out the dirty ſtraw, and being oppoſite to the window, will admit a thorough air, when the lodging-room is cleaned, which will much contribute to render it ſweet and wholeſome. The front doors will be uſeful in drying the room when the hounds are out; and as one is to be ſhut and the other hooked back, ſo as to allow a ſingle dog to paſs, they are not liable to any objection. The large centre window ſhould have a folding ſhutter, which at night, according to the weather, may be wholly or partially cloſed; and thus the *warmth* of the kennel may be regulated as is judged moſt ſalutary. The two great lodging rooms are exactly ſimilar, and having a court belonging to each, are diſtinct kennels ſituated at the oppoſite ends of the building. In the centre of the boiling-houſe and feeding-yard, a leſſer kennel, either for hounds that are drafted off, hounds that are ſick and lame, or for any other required purpoſe, is on each ſide; at the back of which, it being but half the depth of the two larger kennels, are places for coals, &c. for the uſe of the kennel. There is alſo a ſmall building in the rear for hot bitches.

216 Inner court.

The inner-court floor ſhould be bricked or flagged, and ſloped towards the centre like thoſe of the lodging-room; and water brought in by a leaden pipe, ſhould run through the channel in the middle. In the centre of each court is a well ſufficiently large to dip a bucket for the purpoſe of cleaning the kennel. To keep theſe from wanting repair, they ſhould be faced with ſtone, and to that of the feeding-yard a wooden cover ſhould be fixed. The benches, which muſt be open to let the urine through, ſhould have hinges and hooks in them all, that they may fold up when the kennel is waſhed. They ſhould be made as low as poſſible, that when a hound is tired, he may have no difficulty in jumping up, and at no time be able to creep under them. Recollect that if, owing to the ſmallneſs of the hound, as in beagles, it ſhould be difficult to make the benches ſufficiently low, it will be proper to nail a ledging projecting downwards in the edge, or the benches may be faced with boards at bottom, to prevent the hounds from creeping under.

A large bricked court in front, having a graſs court adjoining, and a brook running through the middle of it, completes the kennel. This court ſhould be planted round, and alſo have ſome lime trees and ſome horſe cheſnuts near the centre for ſhade. Some poſts bound round with ſtraw, rubbed with galbanum, may be placed ſo as to prevent the hounds from making water againſt the trees. The brook may be uſed as a cold bath for hounds lamed, in the ſtifle, in ſtrains, or for other purpoſes for which the cold bath is required. A high paling ſhould incloſe the whole, and which, to the height of four feet, ſhould be cloſe, the remainder being open, with an interval of two inches between the pales. At the back of the kennel ſhould be a thatched houſe, fenced at the ſides, to contain at leaſt a load of ſtraw,

Hygeiology a pit for receiving the dung, and a gallows for the flesh. If a piece of ground adjoining to the kennel can conveniently be enclosed, for keeping such horses as may be brought alive for the use of the hounds, it would be of great service, as the disorders of condemned horses are not always ascertained; and an opportunity may thus be offered of investigating their nature and progress, which may prove advantageous in future similar cases. The hounds may also be brought into this field, to empty themselves after feeding; and the draught for the next day's hunt can be here made with greater accuracy than when they are confined to the kennel.

Stoves are used in some kennels; but a good feeder, and the mop properly applied, render them unnecessary. Should ticks prove troublesome at any time, the walls of the kennel should be well washed; and if that should fail to destroy the ticks, they must be white-washed with lime.

217 When the hunting season is over, one kennel will be sufficient, and the other with the grass-yard adjoining to it may be allowed to the young hounds. This separation, which should continue till the season commences, is necessary for preventing many accidents that might otherwise happen at this time of the year. Should there be conveniences, it will be proper to keep the dogs separate from the bitches during the summer months. When hounds are very riotous, the feeder may sleep in a cot in an adjoining kennel; if the dogs are well chastised at the first quarrel, his voice will afterwards be sufficient to keep them quiet *.

* *Daniel's Rural Sports*, vol. i.

Chap. II. *Of Diet.*

218 Diet

In preserving the health of domestic animals, much will depend on the quantity and quality of their food, and on the manner in which they are supplied with it. This subject, therefore, requires some share of our attention. We have already, in the article Agriculture, treated pretty much at large on the different kinds of food that are most proper for horses, sheep, and cattle; and have here little to add on that head. Our principal object in this chapter will be, to consider the best means of dispensing food to the different classes of domestic animals, and to describe what are considered the most beneficial methods of preparing the food in those cases where its preparation appears to be necessary.

219 Food of horses.

The natural food of the horse is the simple herbage of the field, and on it alone he can be constantly kept in a high state of health and vigour, so long as he shall not be required to labour; and whilst he is employed in labour, grass in some form, either dried or green, seems absolutely necessary to his maintenance in a healthy state. Hay, straw, and corn of various kinds have been, from the earliest time, the common food of horses; but in Britain, and indeed in France and Germany, during later periods especially, they have rejected all other species of horse-corn, from a well-grounded preference in favour of oats and beans; the latter for draught-horses chiefly, or as substantial auxiliaries to the oats, imparting as strong a nourishment as the constitution of the horse will properly bear, and at the same time of a cleansing nature; and are, moreover, the best and cheapest in-door fattening for almost all domestic animals. Hygeiology

220 The species of corn usually given to horses in many countries is barley, the bulky provender is straw, both of which in warm climates, are said to be nearly equal in nutriment to our oats and hay. With us, barley is apt to scour horses, and make their urine red, especially at its first being given. Wheat is often given to horses of the great upon the continent; it is said when Philip of Spain was in this country, his jennets were fed upon wheat during the time of scarcity, and this gave great umbrage to the people.

There seems to exist no particular difference of quality between the white and the black oats, they being equal in weight and thinness of husk: these criteria, and their being short, are the best marks of their goodness. It is equally well known that they should be some months old when used, as new oats are apt to swell the belly and produce gripes.

221 Beans. New beans are improper for horses, for the same reason. The best remedy is to dry them in a kiln. Old beans should be split, and given either with bran or chaff; or the best way would be to break them in a mill. Mr Lawrence fed cart-horses with beans for nearly seven years, without experiencing any ill effect from such food; but the horses laboured very hard. Beans contain more solid nourishment than oats, but of a less salubrious nature.

Grains constantly loosen a horse, and impoverish his blood; bran scours and weakens the entrails; both of them are good occasional dietetic alteratives.

222 Carrots. Carrots are said to purify and sweeten the blood, to amend the wind, and to replenish after the wastings occasioned by disease or inordinate labour. Mr Lawrence informs us that he has been accustomed to use them for years in all forms, and to all descriptions of horses. They are either given in spring or autumn to high-fed horses, as a change of diet, at the rate of one feed per day, in lieu of a feed of corn, or as full subsistence to others. They ought to be washed clean, and, if large, cut into flat and sizeable pieces. The quantity of carrots for a feed is from half a peck to a peck.

223 Times of feeding. The usual periods of feeding with corn are in this country, morning, noon, and night. The quantities each time either a quarter or half a peck, with or without about two handfuls of beans, according to the horse's state of body. Much greater care than is common ought to be taken in sifting the oats clean from dust, and the dung of mice. Water should be allowed without fail twice a-day. There is an error not unfrequent among stable people, who suppose water to be at best but a kind of necessary evil to horses, and therefore think it a point gained whenever they can find an opportunity to abridge the quantity. But how well soever a horse may shift with little or no water while in the field, and while feeding on succulent meat, much mischief may ensue from its being withheld; and this may produce costiveness, gripes, inflammation of the bowels, perpetual longing, and a danger of drinking to excess on every opportunity.

224 Hay. The well-known use of hay is to dilate the body of the horse, to satisfy his appetite with bulk and quantity, as corn does with compact and solid nourishment. British hay, the best in the world, contains great nourishment,

Hygeiology nouriſhment, and will keep a horſe and even fatten him; but he is unable to labour upon hay alone, and experience has ſhewn that Bracken's obſervation of the conſtant uſe of hay injuring the ſight of horſes, particularly if ſuddenly put on ſuch food after good keeping, is very juſt. Hard upland hay is the beſt for race and coach horſes; and it ſhould be of a fine, greeniſh colour, fragrant ſcent, and full of flower. It is ſaid that horſes and cattle prefer ſuch hay as has been ſweated, or which has undergone a partial fermentation: and it is even thought that they grow much ſooner fat on heated hay than on ſuch as has been gotten up dry and cool. There can be no doubt that ſweated hay contains a conſiderable quantity of ſugar, formed during its ſtate of fermentation; this may render the hay more palatable to the beaſts, but we have ſome doubt whether it be ſo wholeſome as freſh well-coloured hay. Clover-hay, and hay of artificial graſſes, from its groſsneſs, is appropriated to cart-horſes. Without attempting to aſcertain the preciſe quantity, it may be ſaid that hay ſhould be given as often as a horſe has a keen appetite for it; but great care ſhould be taken that ſo much be never allowed at once, as that he ſhall leave it, and blow upon it. At night a conſiderable quantity of hay is uſually left in the rack, and this is no doubt abſolutely neceſſary for horſes who are hard worked during the day, as night is their moſt leiſure time for feeding; but it admits of doubt whether horſes who live in a ſtate of luxury, and are but little worked, ſhould be indulged in much hay at night *.

*Lawrence on Horſes, vol. ii. 225

It will obviouſly occur to moſt people, that the quantity and quality of a horſe's food ſhould be proportioned to his labour; that horſes who are lightly worked, will not in general require ſo much or ſo nouriſhing food, as thoſe who are conſtantly kept to hard labour. It is evident that when horſes ſtand idle, and are at the ſame time high fed, they are expoſed to many dangerous diſeaſes, as inflammation, ſtaggers, ariſing from a too full habit of body; and theſe diſeaſes will be more likely to come on when a horſe that has been thus fed is ſuddenly put to hard labour, or obliged to make any unuſual or violent exertion. But this muſt not be carried too far. Horſes ſhould not, becauſe they have little work at the time, be entirely confined to graſs, or graſs and hay, unleſs they are at paſture, and are never worked. For while a horſe ſtands in the ſtable, and is liable to be called upon on any emergency, his diet ſhould be ſo regulated, as that he ſhall neither be ſo fat and full of blood, as not to perform occaſional work without difficulty and danger, nor on the other hand, ſo poor and weak, as to be incapable of ſupporting exertion without injury to himſelf or rider. All horſes that are fed on graſs and hay alone, are too weak to perform a good day's journey without ſtumbling. A moderate quantity of corn or other hard food, ſhould therefore be allowed to ſuch horſes as ſtand conſtantly in the ſtable, or who, while at paſture, are occaſionally worked.

226 Mr Clark obſerves, that throwing great quantities of clean grain before horſes at one time is very improper; as they eat it too greedily, and ſwallow whole mouthfuls of it almoſt dry. The moiſture in the ſtomach, or water drunk immediately after eating, cauſes the grain to ſwell, and thus the ſtomach is greatly diſtended, and loſes its contracting power on the food. By the preſſure of the full ſtomach on the inteſtines, the paſſage of the food backwards is obſtructed, and the confined air, ariſing from the indigeſted food, not having a ready paſſage backwards, and horſes not poſſeſſing the power of belching, the air becomes rareſied to a great degree, the horſe is ſeized with colic pains; as theſe increaſe he becomes convulſed, and in many caſes the ſtomach burſts. Out of a number of caſes where the above was diſcovered on diſſecting the bodies, Mr Clark mentions the two following. Hygeiology

"A young draught-horſe was fed in the morning with too great a quantity of barley mixed with peaſe, and had been allowed to drink water immediately thereafter. He was yoked to a two-wheeled chaiſe, in order to travel a few miles, and was obſerved about the middle of the day to be very uneaſy, frequently attempting to lie down. As ſoon as he was unyoked he lay down and tumbled about, frequently lying on his back, ſtarting up ſuddenly and turning his head towards his belly. He continued thus in great agony till towards next morning, when he died. Upon opening his body, the ſtomach was found burſt, the barley and peaſe moſtly entire, only greatly ſwelled, and the whole contents of the ſtomach ſpread through the abdomen.

"The other caſe was a horſe who had been fed with too great a quantity of oats and barley, and had been allowed to drink water freely afterwards. He was ſeized with griping pains, ſo that he frequently lay down and tumbled, ſeemingly tortured with the moſt acute pains. He died next day. Upon opening his body, the ſtomach was found diſtended to a moſt enormous ſize, but was not burſt. Its coats were ſo very thin, from the great diſtention it had undergone, that its coheſion was almoſt deſtroyed, and had more the appearance of a coat of mucus, or ſlime, than the ſtomach. The oats and barley were for the moſt part entire as they were ſwallowed, only greatly ſwelled from the moiſture they had imbibed.

"From the caſes now related, it will appear how neceſſary it is not to allow horſes to eat too great a quantity of clean grain at a time, but to give it in ſmall quantities, and repeated the more frequently. At the ſame time, it will ſhow the propriety of mixing with it a little chopped ſtraw, or hay, in order to make them chew it the more thoroughly before they ſwallow it. This proceſs alſo prepares the food for being properly digeſted, and not a ſingle grain of it is loſt *." * *Clark on Prevention.*

The method of feeding horſes with bruiſed grain and cut ſtraw is recommended by the earl of Pembroke, in his excellent treatiſe on horſes, as exceedingly proper. "Every grain (ſays he) goes to nouriſhment: none is to be found in the dung; and three feeds of it go further than four as commonly given which have not been in the mill. But wheaten ſtraw, and a little hay ſometimes mixed with it, is excellent food. To a quantity of corn, put the ſame quantity of ſtraw. It obliges them to chew their meat, and is many other ways of uſe †." 227 Cut ſtraw. † *Military Equitation.*

Mr Lawrence diſapproves of the uſe of ſtraw, as containing no nouriſhment. In this he probably goes too far, as both horſes and cattle are in ſtraw-yards often fed with little elſe. He prefers chaff, or cut clover hay, to mix with the corn, eſpecially for cart-horſes. Mr Lawrence, however, allows that cutting

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up unthrashed oats for food is a good practice, particularly when hay is scarce; as thrashing and dressing of the oats are thus saved, and it is an economical expenditure of the oats, which are moreover very fresh, and agreeable to the horse.

228 Of grinding corn for horses.

It has of late been recommended to bruise the corn in a mill, before giving it to the horse, and it is certainly a good practice, as there is thus little danger of its passing through the bowels undigested. It is usual only to bruise the corn, but Mr Lawrence thinks that it is better to grind them as fine as possible. Whole corn, with whatever it may be mixed, will, much of it, be swallowed in that state; a great deal only half masticated, which will elude the digestive powers of the animal, and be ejected from his body crude and unbroken. This is particularly the case with brood-mares and young stock, the bellies of which are full of slippery grass; such should ever have ground corn, and mashes should always be made with it. Ground buck-wheat agrees well enough with horses, but that species of corn is the least substantial.

229 Lawson's food for horses and cattle.

Mr Lawson, a merchant of London, has lately published an essay, on the use of Mixed and Compressed Cattle Fodder, intended as food and fattening for horses, oxen, sheep, and hogs. His plan is, to grind, cut, mix and compress, all the articles in present use, as food for cattle, with some additional ones of his own recommending; and to keep the mass stowed in casks, or other close stowage. He gives a detailed account of all the instruments necessary in the process, the most commodious methods according to his own practice, and various tables of expence and quantities.

With respect to the drink of horses, we have little to remark. Their water should be as pure as possible, as muddy and hard water is not only very unpleasant to the horse, but probably lays the foundation of gravelly complaints. It is a very absurd custom, which is however very prevalent, to gallop the horse after watering, with the view, according to the groom's idea, of warming the water in his belly; for if the horse has drunk heartily, as he is very often improperly allowed to do, any violent exertion immediately after cannot but occasion great uneasiness. It is, however, a good practice to ride the horse moderately before watering; but care should be taken, not to throw him into a perspiration, as drinking cold water in this state is attended with considerable danger.

230 Food of cattle.

The feeding of cattle is of considerable importance to the farmer, and has of late been much improved. Both the food and the manner of administering it must be different according to the age of the cattle, the season of the year, and the purposes for which the cattle are fed.

It has been well observed in a late useful practical work, that in the winter the yearlings should "be fed with hay and roots, either turnips, carrots, or potatoes; and they should be thoroughly well fed, and kept perfectly clean by means of litter. At this age it is a matter of great consequence to keep such young cattle as well as possible; for the contrary practice will inevitably stop their growth, which cannot be recovered by the best summer food. If hay is not to be had, good straw must be substituted; but then the roots should be given in greater plenty, and with more attention. To steers and horses two years old, the proper food is hay, if cheap, or straw, with baits of turnips, cabbages, &c.*"

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* Dickson's Agriculture, vol. ii.

Mr Donaldson thinks the advantages of green winter food for live stock, so great, that there is no way in which it can be applied with greater benefit than "by giving the young cattle a daily allowance during the first two or three winters." Whenever straw is employed as fodder for young stock, without the above sorts of food, if it be not very good, or slightly mixed with some grassy material, a little hay should always be blended with it, in order that it may be preserved in proper condition. It is also of consequence that the animals be served with this sort of fodder, in a regular manner, as where too much is given at a time, Mr Marshall has remarked, that they do not thrive so well.

The following observations of Sir John Sinclair merit every attention.

231 Sir John Sinclair's remarks.

"Some intelligent graziers recommend the following mode of feeding and fattening cattle. Suppose there are four inclosures, of from six to ten acres each, one of them should be kept quite free from stock till the grass has got up; and then the prime or falling cattle, should be put into it, that they may get the best of the food: the second best should then follow; and the young store after all, making the whole feed over the four inclosures in succession, as follows.

1st Inclosure.	*Free from stock, till ready for the best cattle.*
2d ditto.	*For the best cattle, till sent to* N° 1.
3d ditto.	*For the second best, till sent to* N° 2.
4th ditto.	*For the young cattle, till sent to* N° 3.

N° 4. is then kept free from stock till the grass gets up, and it is ready for the prime cattle. The proper size of inclosures has never yet been ascertained by experiment; probably from 10 to 30 acres is the best; but the size should be various, as small ones are better calculated for grass, and large ones for corn. Probably the best plan to adopt is, to feed cattle entirely in the house, or *soiling* them as it is technically called. In that case, small inclosures must be preferred, as the shelter they afford is extremely favourable to the growth of the herbage.

232 The larger a bullock is, he must take the more food to support him. It is desirable to change his food often, and to give him frequently, but little at a time, which makes him more eager to eat. After his kidneys are covered with fat, he will take less meat every week. It is better, therefore, to ascertain the quantity he eats, by the week, than by the day.

233 Fatting cattle, to be sold immediately from the farmer's house, and not sent to market, should be kept moderately warm. If kept too hot it makes them perspire, and their skins to itch: this vexes them, and they rub themselves against any wall or post within their reach, which is much against quick feeding. Currying and combing them are useful practices; and washing them, at least once a-week, is of great service. Bleeding is now exploded, as an old and unnecessary practice.

234 In some parts of the kingdom, the whole attention of the farmer is dedicated to suckling, or, in other words, to feeding calves, for supplying the market with veal. In Essex, this plan is reckoned more profitable than the dairy, and next to grazing. But the profit there must depend much upon the immediate neighbourhood of

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of that country, to ſo great and certain a market as London.

235 Eſſex mode of rearing calves.

The particulars connected with this branch of rural economy, will, it is probable, be fully detailed, in the improved Agricultural Survey of Eſſex, in ſo far as regards that and the neighbouring diſtricts. But as the mode of ſuckling, adopted in ſome parts of Scotland, is extremely different, it may not be improper to give a ſhort account of it in this place. As ſoon as the calf is dropped, it is put into a box made of coarſe boards, four feet and a half or five feet long, and four feet, or four feet and a half high, and about two feet wide, according to the ſize of the calf. The boards are not put ſo cloſe but that a ſufficient quantity of air is admitted; light is, however, carefully excluded; and the box has a cover for that purpoſe. The box ſtands on four feet, which, at one end, are four inches high, but at the other, only two inches; and, as there are holes at the bottom, all wetneſs is drained off. The bottom is alſo covered with ſtraw or hay, which is changed twice a-week. For ſeven or eight days, milk is but cautiouſly given, for unleſs a calf is fed moderately at firſt, it is apt to take a loathing to its food. It ſhould be bled in about ten days; and afterwards, as much milk given it freſh from the cow, either twice or thrice a-day, as it will take. The bleeding ſhould be repeated once a-week; and at all times when a calf loathes its milk, and does not feed well, bleeding ought to be repeated. Theſe frequent bleedings prevent diſeaſes from plethora, to which calves are ſubject, even when not fed ſo high, and ſtill more ſo when they are. A large piece of chalk ſhould be hung up in the box, which the calf will lick occaſionally: this contributes nothing to the whiteneſs of the veal; but it amuſes the animal, and corrects that acidity in the ſtomach which might otherwiſe be engendered, and which certainly often takes place. A cow calf is reckoned the beſt veal; if a bull calf is ſuckled, he ought to be cut when about a week old; otherwiſe the veal will neither be ſo good nor ſo white. By this mode of treatment, calves are kept clean, quiet, warm, and dry; the veal they furniſh is excellent, and they are ſoon ready for the market; and, on the whole, it ſeems to be preferable to the practice of ſtupifying them with ſpirits, or with laudanum, ſo common in other places where a different ſyſtem is purſued.

The ſuppoſed neceſſity of beginning to feed oxen at an early age, is a great objection to their being generally uſed, as they are hardly trained properly to work, before it is thought neceſſary to fatten them, after which they do very little work; but, in conſequence of the improved mode of fattening by oil-cake, &c. there is no difficulty to fatten oxen, even at twelve years of age, which is a material circumſtance in their favour *."

* *Farm. Mag.* vol. iii. 163.

236 Mr Hunter's feeding byre.

It is now very generally underſtood, that the more cleanly and comfortably cattle are kept, and the cleaner and better the order in which their food is preſented to them, the better they will thrive, and conſequently the ſooner they will fatten, and the heavier they will be. With theſe views, and with the additional view of ſaving a greater proportion of the dung and urine of the cattle than is uſually done, ſo as to increaſe the quantity of manure as much as poſſible, a byre has been conſtructed by Mr Hunter of Blackneſs in Forfarſhire, which has been found on trial, completely to anſwer the ends propoſed. The byre conſiſts of two apartments, an inner apartment, or byre for feeding the cattle, and an outer apartment or barn for containing the turnips and fodder. Hygeiology

At the proper ſeaſon when the turnips are completely ripened, and the turnip feeding commences, the turnips are gathered together on the field in large quantities, and two or three men with coarſe turnip knives made from old ſcythes, cut off the whole of the roots, carefully cleaning the turnips at the ſame time, from any earth which may adhere to them. The turnips are then carted to the turnip barn, the door of which is wide enough to allow the carts to back in, and throw them down. Here the men with their turnip knives are again ready immediately to cut off the whole green tops or ſhaws of the turnips, and theſe green tops are immediately given to cows, young winterling cattle, ſheep, &c. who readily eat them when freſh. The turnips, now quite clean, are piled up in one end of the barn like cannon balls, and will keep in excellent order for months together. Should the winter ſtorm ſet in, a ſmall quantity of clean dry ſtraw laid over them, will effectually preſerve them from being injured by the froſt. The other end of the barn receives the ſtraw and litter for the uſe of the byre. The advantages propoſed to be derived from this method of treating the turnips are, 1. The preſervation of a great many of the beſt turnips, which, if allowed to remain on the field during winter, are unavoidably ſpoiled by the effects of the weather, and the alternate operations of ſnow, rain, and froſt. 2. The green tops being cut off freſh and good, are immediately conſumed, in place of being entirely loſt if allowed to remain on the field. 3. It ſaves much labour and trouble, both to men and horſes, to lay in a ſtock of turnips at once, in place of going to the field every day, whether good or bad, and when, as the fields are neceſſarily wet and ſoft, the horſes, carts, and harneſs, are ſeverely ſtrained, and the fields poached and cut up.

Laſtly, By having a couple of months ſupply of turnips in the barn, you are never under the neceſſity of uſing froſted turnips, which are often little better than lumps of ice. And even if you ſhould not incline, or find it convenient, to lay in ſo large a ſtock of turnips at once, ſtill you can take the advantage of any good freſh day, as it occurs, to add to your ſtock of turnips in the barn.

At right angles to the turnip barn, ſtands the feeding byre, conſtructed as follows. At the diſtance of about three feet and a half from the great ſide wall of the byre, there are conſtructed on the ground, in a ſtraight line, ten troughs for feeding ten large cattle; theſe are of hewn pavement on all ſides, and at the bottom; and they are divided from each other by diviſions or bridges, likewiſe of hewn pavement. Theſe troughs are ſo conſtructed, that there is a ſmall and gradual declivity from the firſt or innermoſt, to the laſt and outermoſt one; and the bridges ſeparating them, being made with a ſmall arch at the bottom, a pail or bucket of water poured in at the uppermoſt, runs out at the undermoſt one, through a ſtone ſpout paſſing through the wall, and a ſweep with a broom, carries off the whole remains of the turnips, &c. rendering the whole troughs quite clean and ſweet. The whole food of the cattle is thus kept perfectly clean at all times.

In a line with the feeding troughs, and immediately

over

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over them, runs a large ſtrong beam of wood, from one end of the byre to the other, which is ſtrengthened by two ſtrong upright ſupporters to the roof, placed at equal diſtances from the ends of the byre, and the main beam is again ſubdivided by the cattle ſtakes and chains, ſo as to keep each of the ten oxen oppoſite to his own feeding trough and ſtall.

The three and a half feet of ſpace betwixt the feeding troughs and outer wall of the byre, lighted at the farther end by a glazed window, is the cattle-feeder's walk, who paſſes along it in front of the cattle; and, with a baſket, depoſits before each of the cattle the turnips into the feeding trough of each.

To prevent any of the cattle from choaking on ſmall turnips, or pieces of large ones, as they are very apt to do, the chains at the ſtakes are contrived of ſuch a length, that no ox can raiſe his head too high when eating; for, in this way, it is obſerved, cattle are generally choaked. However, in caſe it ſtill ſhould happen, that an ox choaks on a turnip, the cattle-man, or feeder is provided with a ramrod, made of a piece of ſtrong ſtiff rope, with a ſmall round poliſhed wooden head at the end of it; this he introduces into the mouth of the ox, and ſo gently knocks the turnip down his throat, without either difficulty or danger to the animal. That the cattle-feeder may be always at hand to attend his cattle, a ſmall apartment with a window in it, in which his bed is placed, is conſtructed immediately off the corner of the byre, ſo that he is ready, even in the night-time, in caſe of any accident happening, to give aſſiſtance.

At the diſtance of about ſix feet eight inches from the feeding troughs, and parallel to them, is the dung groop and urine gutter, neatly and ſubſtantially built with hewn ſtone. Here, too, like the troughs, there is a gradual declivity from the inner and upper to the outer and loweſt end; ſo that the moment the urine paſſes from the cattle, it runs to the loweſt end of the gutter, whence it is conveyed through the outer wall of the byre in a large ſtone ſpout, and depoſited in the urinarium outſide of the wall. At this place is a large incloſed ſpace, occupied as a compoſt dung-court. Here, all ſorts of ſtuff are collected for increaſing the manure; ſuch as, fat earth, cleanings of roads, ditches, ponds, &c. rotten vegetables, &c.; and the urine from the byre being cauſed to run over all theſe collected together, which is done very eaſily by a couple of wooden ſpouts moved backwards and forwards to the urinarium at pleaſure, renders the whole maſs in a ſhort time, a rich compoſt dunghill; and this is done by the urine alone, which in general is totally loſt. The dung of the byre again is cleaned out ſeveral times each day, at the two front doors of the byre oppoſite to the groop, and depoſited in the dung-court; ſo that, in this way, too, the byre is kept in as good order as any ſtable, and the cattle as clean as horſes. Along the edge of the dung-court, a few low ſheds are conſtructed, in which young beaſts, ſheep, or ſwine, &c. are kept; and theſe conſume the refuſe and remains of the turnips from the great feeding byre.

In the ſide wall of the byre, and oppoſite to the heads of the cattle, there are conſtructed three vents, or ventilators; theſe are placed at the diſtance of about two feet four inches from the ground in the inſide of the byre, and come out immediately under the eaſing of the ſlates on the outſide. The inſide openings of theſe are about 13 inches in length, ſeven in breadth, and nine in depth in the wall; and they ſerve two good purpoſes. 1. The breath of cattle being ſpecifically lighter than atmoſpheric air; the conſequence is, that, in ſome byres, the cattle are kept in a conſtant heat and ſweat, becauſe their breath and heat have no way to eſcape; whereas, by means of the ventilators, the air of the byre is kept in proper circulation, which conduces as much to the health of the cattle as to the preſervation of the walls and timber of the byre, by drying up the moiſture produced from the breath and ſweat of the cattle, which is found to injure thoſe parts of the building *.

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*See *Farm. Mag.* vol. iii. p. 8.

237 London mode of feeding cows.

The method of giving cows their food by the milk-farmers in the vicinity of the metropolis, where this buſineſs is carried on upon the moſt extenſive ſcale, is thus ſtated in the valuable Agricultural Survey of that diſtrict. "During the night, the cows are confined in ſtalls; about three o'clock in the morning, each cow has a half-buſhel baſket of grains; when the milking is finiſhed, a buſhel baſket of turnips is given to each cow; and very ſoon afterwards they have an allotment in the proportion of one buſs to ten cows, of the moſt graſſy and ſoft meadow hay, which had been the moſt early mown, and cured of the greeneſt colour. Theſe ſeveral feedings are generally made before eight o'clock in the morning, at which time the cows are turned into the cow-yard. About twelve o'clock they are again confined to their ſtalls, and ſerved with the ſame quantity as they had in the morning. When the afternoon milking, which continues till near three, is finiſhed, the cows are again ſerved with the ſame quantity of turnips, and about an hour afterwards with the ſame diſtribution of hay, as before deſcribed. This mode of feeding generally continues during the turnip ſeaſon, which is from the month of September to the month of May. During the other months of the year they are fed with grains, cabbages, tares, and the other foregoing proportion of ſecond cut meadow hay, and are continued to be fed with the ſame regularity until they are turned out to graſs, when they continue in the field all night; and even during this ſeaſon they are frequently fed with grains."

As the grains employed in feeding cattle cannot always be procured freſh as they are wanted, it becomes a deſirable object to preſerve them for a length of time. They are preſerved in ſome places by putting them into pits dug in the earth, into which they are trodden down, and afterwards covered to a moderate depth with dry earth. In this way being defended from the action of the air, and thus prevented from fermenting, they may be kept for a conſiderable time during the months of ſummer, when brewing is not carrying on; they may alſo be kept by preſſing them down into caſks placed upon ſtands, ſo as to elevate them a little from the ground, and having their bottoms pierced with holes, to carry off the ſuperabundant moiſture.

Food of Dogs.

238 Food of dogs.

A good feeder is very eſſential. He ſhould be young, active, induſtrious, and good tempered, for the ſake of the animals entruſted to his care, who, however they may be treated by him, cannot complain. He muſt ſtrictly obey any orders that his maſter may give, both

Hygeiology both with regard to the management and to the breeding of the hounds, and he muſt not conſider himſelf as ſolely under the direction of the huntſman. This is a neceſſary hint, as it has ſometimes happened that a pack of hounds apparently belonged entirely to the huntſman, when the maſter had little more authority over them than if he were a perfect ſtranger.

239 Cleanlineſs. On the exquiſite ſenſe of ſmelling ſo peculiar to the hound, our ſport entirely depends; care muſt therefore be taken to preſerve it, and the ſureſt method of doing ſo is, to obſerve the utmoſt cleanlineſs; to keep the kennel ſweet, is a point that cannot be too much recommended, and which muſt on no account be neglected. This muſt therefore be inculcated on the feeder, and the proprietor ſhould ſee that his orders in this reſpect are carefully obſerved.

240 Of vegetable food. Oat meal is by far the heartieſt and beſt food; for hounds will run more ſtoutly with that, than on any other meal, or than even on oat meal mixed with any other. In point of expence, as well as for the greater benefit of the hounds, the moſt advantageous method is to grow one's own oats, and have them properly dried, and broken at the mill into meal that is not too fine. A ſufficient quantity ſhould be ground, to ſerve for 12 or 18 months conſumption; the older the meal, ſo much the better; but unleſs it is kept by one, there is ſcarcely any mode of procuring it ſufficiently old. It ſhould be kept in bins, in a dry granary, and the meal ſhould be trodden into the bins as cloſely as poſſible. Should there be no granary near, ſugar hogſheads will anſwer the purpoſe, but the meal muſt be preſſed into them very firmly, and it muſt be kept dry. Theſe hogſheads ſhould be placed upon ſtands, like beer ſtands, by which means vermin will be prevented from getting at the meal unobſerved.

241 Oat meal.

242 Barley meal. Barley meal is uſed in many kennels, being cheaper than oat meal, but it is ſaid to be much more heating, and leſs nouriſhing; or as the huntſmen expreſs themſelves, there is leſs proof in it.

243 Mode of preparing the food. It is well known that the principal animal food given to hounds, is the fleſh of horſes, which ſhould be boiled. The boiler employed for this purpoſe ſhould be made of caſt iron, and its ſize ſhould be in proportion to the number of hounds in the kennel. The fleſh muſt be thoroughly boiled, and muſt then be taken out of the broth with the ſtrainer, and a proper quantity of oatmeal muſt be put into the broth. When this has been boiled ſufficiently, which will require from three quarters of an hour to an hour, the fire may be withdrawn. As it cools, it thickens into a pretty firm jelly, and for hunting hounds it cannot be too ſtrong. Five or ſix pecks of good oat meal will be ſufficient to make a boiler of broth that will furniſh 30 couple of hounds for two feeds ſufficiently thick. Some are of opinion that oat meal and barley meal in equal quantities make the beſt food for hounds. The oat meal is to be firſt boiled for half an hour, the fire is then to be extinguiſhed, and the barley meal put into the copper, and both mixed together. The reaſon for not putting both kinds of meal into the boiler at the ſame time is, that the boiling which thickens the oat meal, makes the barley meal thin. When barley meal alone is uſed, it ſhould not be put into the boiler at all, but ſhould be ſcalded with the hot liquor, and mixed up in a large tub, capable of containing at leaſt half a hogſhead. We muſt however remark, that barley meal ſhould never be given by itſelf to hunting hounds during the hunting ſeaſon, as its heating quality renders them exceedingly thirſty; and when out, they take every opportunity to lap water. Hygeiology

244 The meat ſhould never be given to the dogs too hot, and ſhould be mixed up to as thick a conſiſtence as may be. The feeding troughs ſhould be wide at the bottom, and have wooden covers, and they ſhould not be made too long; five or ſix troughs that are eaſily moved, are better than two or three that are unwieldy.

The boiling for the hounds, mixing of the meat, and preparing it for them at proper hours, will of courſe be taken care of by the huntſman. He muſt conſtantly attend the feeding of the hounds, who ſhould be draughted according to the ſtate they are in at the time. Some hounds are better feeders than others, and ſome require leſs meat than others; a nice eye and great attention are required to keep them all in equal fleſh. This is what conſtitutes the merit of the huntſman, and ſhews him to be well qualified for his office; but few are ſufficiently attentive to this. The hounds are fed in a hurry, without examining them before they begin. To aſcertain properly the condition of a pack of hounds requires no ſmall circumſpection.

245 Mode of adminiſtering it. The huntſman ſhould call each hound by name, letting him in to his food as he is called; this uſes them to their name, and teaches them obedience. A hound ſhould always approach him who calls on him; and if he touches him with a ſtick, he ſhould follow wherever he is led.

The thin and tender feeding hounds being firſt turned out to the feeding room, will have the opportunity of picking where they chooſe. Such hounds as are in low condition, had better be drafted off into a ſeparate kennel. Thus ſelecting thoſe that are poor, we proceed to the feeding of the reſt with leſs trouble and more accuracy; but thoſe that are drafted off, when more fleſh is mixed with the meat, muſt be let in to feed one by one as they anſwer to their names; or they may be better fed than taught. Thus the hounds who want fleſh, will all have a ſhare of it; and if any of them be much poorer than the reſt, they ſhould be fed again, as ſuch hounds cannot be fed too often. Unleſs peculiarly good, a ſoft waſhy conſtitutioned hound will ſcarcely ever be worth the attention that is given him; and after a hard day is frequently unſerviceable for ſome time. It muſt be recollected, however, that ſuch hounds as are tender, or lean feeders, cannot be fed too late, or with too rich meat. Should any hounds appear to get too fat, they muſt not be ſuffered to eat their fill, but the reſt may eat as much of the meat as they pleaſe.

246 Once a week, or fortnight at moſt, during the hunting ſeaſon, the hounds ſhould have a pound of ſulphur given them in their meat; and when the ſeaſon is over, they ſhould have half a pound of antimony added to the ſulphur, and well mixed with the meat. On theſe days, the hounds ſhould all be let in to feed together, and ſuch as require fleſh, have it given to them afterwards. Greens boiled in their meat once a week, is likewiſe proper. A horſe killed and given to hounds whilſt warm, after a very hard day's hunting, will make an excellent meal, but they ſhould not hunt again till three days after it. The bones broken are good food for poor hounds, as there is conſiderable nouriſhment in them.

Sheep-

Hygeiology Sheeps trotters are alſo very ſweet food, and in a ſcarcity of horſe fleſh, bullocks paunches may be employed with advantage.

247 It is cuſtomary with ſome to ſhut up the hounds for two hours after they have returned from hunting, before they are fed, and the other hounds are ſhut up with them to lick them clean; but probably this practice does more harm than good, as the idle hounds will diſturb the tired dogs more by their licking, than this will make amends for. Beſides, hounds ſhut up on their return from hunting, will not afterwards readily quit their benches, as, if much fatigued, they will ſeek repoſe rather than food. It is therefore a better way when the hunt is nearly over, to ſend forward a ſervant to ſee the meat prepared, that the dogs may be fed immediately on their return. If they have had a ſevere day, they ſhould be fed again afterwards. When hounds are fed twice, they ſhould be kept ſeparate from the hounds that were left at home, till after the ſecond feeding, and it will be ſtill better if they are not put together till the next morning. It is the beſt plan to feed the hounds that have been out twice. Some hounds will feed better the ſecond time than the firſt, and beſides, the turning them out from the lodging houſe refreſhes them, and allows them to ſtretch their limbs; and if the kennel is cleaned out, and the litter well ſhaken up, they will afterwards ſettle themſelves better on their benches. It is at all times proper, after feeding, to turn out the dogs into the graſs court, as this contributes very much to the cleanlineſs of the kennel.

Chap. III. *Of Exerciſe.*

248 Exerciſe. Nature dictates the neceſſity of exerciſe to almoſt every animal, and a greater or leſs proportion of it is neceſſary to enable them to perform their functions with health and activity. The proportion requiſite for this purpoſe is, however, not the ſame in all animals. Sheep and cattle require but little exerciſe, much of which, indeed, appears to be incompatible with the manner of their eating; for, as they require a ſecond maſtication of their food by rumination, a conſiderable time is neceſſary for this proceſs, which cannot be properly performed, unleſs the animal be entirely at its eaſe. It is found, however, that ſuch of theſe animals as are kept without exerciſe, or are wholly cooped up in houſes, for the purpoſe of fattening them more ſpeedily, are neither ſo healthy, nor afford ſuch fine and wholeſome meat, as thoſe which are permitted to rove at large in their native paſtures. It is to the horſe and dog that exerciſe ſeems the moſt eſſential. Theſe animals require the greateſt proportion, and are moſt injured by the want of it. The obſervations we are about to make will chiefly apply to the horſe.

Such horſes as are conſtantly employed in active labour have, of courſe, ſufficient exerciſe; but it often happens that thoſe which are kept by gentlemen, for their pleaſure or convenience, are, when their labour is not required, permitted to ſtand whole days in the ſtable, without any other exerciſe than being ridden perhaps twice a day to a neighbouring pond. In cities and large towns, even this exerciſe is often not permitted them. They are in the mean time plentifully fed with rich, hard food, and thus pampered, they are rendered liable to the attacks of many acute diſeaſes; and when their exertions are required, they cannot perform their uſual labour with their uſual eaſe. It is therefore Hygeiology neceſſary that ſuch horſes as are not regularly worked ſhould receive daily a moderate proportion of exerciſe, and ſhould be accuſtomed to ſuch a degree of labour as may counterbalance the effect of high feeding, and enable them to undergo occaſional exertion. A horſe who is kept in the ſtate of regular labour is ſaid to be in *wind*. The exerciſe of a horſe that is not conſtantly worked ſhould not, however be exceſſive, or be carried beyond the commencement of fatigue, as this would wear out the horſe without neceſſity. It is an abſurd practice which ſome people purſue, to ſend out their horſes every day to be galloped and rattled along the roads, or perhaps over the ſtreets, for the purpoſe of keeping them in wind. This is wrong, even where the horſe is in good health and ſound condition; but when it is practiſed with ſinew-ſtrained, or foundered horſes, as is not uncommon, it muſt be productive of conſiderable miſchief.

In general, two hours a-day will be ſufficient for the purpoſe of preſerving the health of the horſe, and this may be taken at once or twice in the day, as may be moſt convenient. If poſſible, the owner ſhould ride his own horſe on theſe exerciſing jaunts, for the groom will probably do the horſe more injury than benefit.

Some horſes require more exerciſe than others. Gentlemen's horſes that are merely kept for light riding, will do with but little; but hunters and racers require a greater proportion, and ſhould ſeldom have leſs than three hours a-day. This, however, muſt depend in a great meaſure on the quantity and quality of their food, as the food and exerciſe muſt in general be proportioned to each other; but in all caſes care muſt be taken that the horſe's labour do not exceed his ſtrength. Young horſes are not equal to much exertion, and ſhould therefore be exerciſed but lightly. Many horſes have been deſtroyed by the neglect of this precaution, eſpecially in the army, where it is not unuſual to receive horſes as recruits of four or even three years of age. Theſe horſes, when they reach the regiment, to which they are probably brought from a conſiderable diſtance, are in general weak and in low condition, and are probably ſuffering from ſome acute diſeaſe, brought on them by expoſure to cold and wet during their journey. They are of courſe very unfit for labour, and require at leaſt three or four weeks reſt, before they can with propriety be brought to go through their exerciſes in the riding ſchool. According to Mr White, however, they are ſeldom allowed the half of that time, but are brought too haſtily into the ſchool, without reflecting that, as they are unaccuſtomed to ſuch exerciſes, or indeed at that early age to any kind of work, it muſt become exceedingly fatiguing to them; and to young horſes in a ſtate of debility, eſpecially if they are not immediately attended to, when brought ſweating from the riding ſchool, ſuch labour muſt often be followed by the worſt conſequences.

Where a horſe cannot be conveniently taken out to the fields or roads, for the purpoſe of exerciſe, expedients have been thought on to exerciſe them within the ſtable, or in a yard adjoining. The ſtable can anſwer for this purpoſe only when it is very large, and he may then be made to trot backwards and forwards till

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till he begins to ſweat, with ſome advantage. We have heard of the governor of a certain town, who fell on a good expedient to exerciſe the horſes of a large body of cavalry that had been received into the town, juſt before the enemy laid ſiege to it. As there was no poſſibility of riding out the horſes, he cauſed a number of the troopers to ſtand about the horſes, two or three at each horſe, and whip them ſo as to make them fly from one ſide of the ſtall to the other, till both men and horſes were ſufficiently heated. It is ſaid that by this means the horſes were kept in a pretty good ſtate of health, whereas they would otherwiſe have been much diſeaſed.

When a horſe comes in from work in a profuſe perſpiration, he ſhould not be ſuffered to ſtand to cool at the ſtable door, but ſhould rather be walked gently about, if the weather will permit of it, or elſe be tied up in his ſtall with a cloth thro n over him. If he is in a violent ſweat, it is a good practice to ſtroke off the ſweat with a ſharp-edged ſtick, as is uſually performed on race-horſes immediately after running the courſe. If he is much fatigued, it will alſo be not amiſs to give him a little ſtrong beer, a ſmall draught of which will conſiderably refreſh him. The French commonly give wine in theſe caſes; but their wine is very weak, and is probably not ſo wholeſome for horſes as our ale.

It is very common with the drivers of coaches, and many grooms, to throw cold water over the legs of horſes, when they come to the end of their journey, ſweating and fatigued. Some even ride them into the water on theſe occaſions, or throw it over a great part of their body. This is a very dangerous practice, and gives occaſion to ſeveral diſeaſes of the legs, joints, and feet. It is more eſpecially to be avoided when the horſe has been long ſweating, as when in this ſtate he is too much weakened to bear the ſhock of the cold water with impunity. When a horſe is overheated without much ſweating or fatigue, the practice would probably not be attended with danger, and bathing him with cold water at that time would perhaps be even beneficial, eſpecially if he were immediately rubbed dry, and covered with a light cloth. But as it is difficult to hit this nice point, this practice muſt be employed with caution, and ſhould never be truſted to the indiſcriminate prudence of a groom or coachman. The inſtances of horſes having been plunged into cold water when overheated, without ſuſtaining any injury, are eaſily explained from the above remark.

M. Lafoſſe makes the following remarks on the exerciſe of horſes. "A horſe on a journey may travel five hours at a time, if not hurried onwards; a manege horſe one hour; a cavalry horſe may manœuvre two hours; a coach horſe, at a ſlow pace, ſix hours. But it is proper that ſaddle horſes ſhould not be overloaded, and that the load of a horſe in harneſs ſhould be in proportion to his ſtrength, in order to perform thoſe proportions of labour, to eſtabliſh which is a difficult point; all depends on quickneſs. We will ſay generally, that a ſaddle horſe, well formed, and muſcular, may thus carry at a ſlow rate, two-thirds of his own weight, and run in a chaiſe, with double and one-half of his weight. It is eaſy to ſee from this, that the load of a ſaddle horſe ſhould be leſs if he is put on the trot, and leſs ſtill if he is made to gallop. The draught horſe, on the contrary, lightens his load by ſpeed, which, however, he cannot long continue without tiring, and being out of breath.

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"The diſorders which proceed from hard work are, founder, fret, and moſt inflammatory diſeaſes. There are others that proceed from ſudden tranſitions from heat to cold, or, on the contrary, ſuch as inflammation of the lungs, colds, glanders, rheumatiſms, and dropſy of the breaſt. Theſe are particularly frequent and dangerous to cavalry horſes. They have exiſted at all times; but the preſent ſyſtem of manœuvres renders them much more common than formerly; they are a ſpecies of endemial diſorders, which alarm many regiments, and make them dread the conſequences. But there can be no doubt they may be avoided in a great degree.

1. By taking no horſe into a regiment under four years old, and thoſe only which are well formed.
2. By giving them forage of good quality.
3. By airing them in the ſtable, and
4. By avoiding to put them in a ſweat, which is a ſtate contrary to nature. This forced perſpiration dries up and impoveriſhes the blood, ſpoils the finer fibres, the veſſels loſe their re-action; hence the ſtagnation of the humours, which produce tumours and farcy. It would be adviſeable then to avoid accidents after a repetition of military exerciſes by walking the horſes quick, and afterwards ſlowly, until they have regained their natural warmth. By this means a repercuſſion of the humours may be avoided. For the ſame reaſon, a horſe ſhould neither be watered, fed, or dreſſed while ſweating; on the contrary, if he muſt be put into the ſtable, take off the ſaddle, rub him down with ſtraw, and cover him with a cloth *."

* *Veterinarian's Pocket Manual*, p. 11.

PART V. VETERINARY MATERIA MEDICA.

249 IN treating of the ſubſtances employed in the cure of the diſeaſes that affect domeſtic animals, we ſhall firſt deſcribe the uſual forms in which they are adminiſtered, with the moſt approved methods of exhibiting each, in the various caſes to which they are applicable. We ſhall then enumerate the remedies themſelves, arranged under certain heads or claſſes, as is uſually done by writers on the materia medica; for the ſake of bringing together under one view, thoſe articles which are ſuited to the ſame purpoſes. We ſhall not at preſent, however, deſcribe the articles made uſe of, as moſt of them are employed in general medicine, and a particular account will be given of them in the article MATERIA MEDICA. Our object here will be to point out the doſes required for the animals of whoſe diſeaſes we are about to treat; and the particular caſes to which they are adapted. To each claſs we ſhall ſubjoin a number of receipts to which we ſhall have occaſion to refer, when we come to the treatment of the diſeaſes.

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250 Forms.

The moſt uſual forms in which medicine is exhibited, to horſes and cattle, are thoſe of powder, ball, drench, clyſter, ointment, poultice, and fomentation.

Powders.

251 Powders.

There are not many ſubſtances which admit of being adminiſtered in the form of powders; for as it is neceſſary to mix theſe with the food of the animal, they muſt of courſe be compoſed of ſuch articles as do not impart to the food any very ſtrong or diſagreeable taſte. The ſubſtances chiefly given in the form of powders are antimony, ſulphur, nitre, and ſome of the aromatic ſeeds, &c. They ſhould be reduced to the fineſt powder, and ſhould be thoroughly mixed with the corn or bran that is placed before the animal. Thoſe powders which do not readily diſſolve in water, ſuch as antimony, ſulphur, and the powder of ſeeds, ſhould be moiſtened before mixing with the food, as in this way leſs of the medicine will be waſted. Emetic tartar, and all articles that require to be given in a ſmall determinate doſe, cannot properly be adminiſtered in this form.

In giving powders mixed with the food of horſes, much will depend on the delicacy of the animal's taſte, and on the ſtate of his ſtomach at the time. Some horſes will readily take their food mixed with medicinal powders, while others refuſe every article offered to them in this form. When this is the caſe, or when the medicine thus adminiſtered appears to diſagree with the animal's ſtomach, this mode of giving it muſt not be repeated; but the medicine muſt be adminiſtered in ſome other form.

Powders are alſo ſometimes uſed externally either to ſores and ulcers, or blown into the eyes.

Balls.

252 Balls.

The form of ball or bolus is one of the moſt common in which internal medicines are adminiſtered in farriery. It is extremely convenient, as there are very few articles that do not admit of being given when mixed up into a ball; as they are, from the peculiar conformation of the animal's throat, more eaſily adminiſtered than any other form that can be given by the mouth. Some articles, however, eſpecially ſuch as eaſily evaporate at the uſual temperature of the air, as ether and volatile alkali, and ſuch as ſpeedily liquefy or deliqueſce by expoſure to a moiſt atmoſphere, are not ſo properly given in the form of balls. Subſtances, too, which require a very large doſe, do not eaſily admit of this form, and are beſt given in infuſion, or mixed with water in the form of a drench.

It is beſt to prepare balls as they are required, or at leaſt not many days before they are needed, as by expoſure to the air they become hard, and do not eaſily diſſolve in the ſtomach; they may even paſs through the bowels nearly unchanged. But what is of ſtill more conſequence, giving a hard ball may endanger the animal's life, by its ſticking in his throat. Mr White ſays, that he has known ſeveral inſtances of horſes being deſtroyed in this way. Sometimes the horſe's jaws are ſo narrow as not to admit of introducing the hand between them. In this caſe, the ball may be fixed lightly on the end of a ſtick or cane, moderately pointed; or, what is ſtill better, placed looſely in a kind of cup fixed on ſuch a ſtick or cane; and thus thruſt to the back of the tongue.

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253 Mode of adminiſtering balls.

The ball ſhould be made not round, but nearly of the ſhape of an egg, and rather leſs in ſize. The mode of adminiſtering balls to horſes requires ſome dexterity. To give a ball with eaſe, the operator ſhould extend his fingers ſo as to ſurround one end of it, while the whole hand and the thumb oppoſite to the finger that ſurround the ball muſt be contracted into as ſmall a ſpace as poſſible, as the ſmaller the hand, the greater will be the eaſe with which the operation is performed, both to the farrier and the horſe. The animal's mouth is uſually kept open by means of an inſtrument called a *balling iron*, that is formed like a ring, with an opening ſufficiently large to admit the hand, and which is covered with cloth, and placed between the horſe's jaws; thus preventing him from ſhutting his mouth, or hurting the operator with his teeth. When the ball is held in this way, in the right hand, the tongue of the animal is to be drawn out with the left hand towards the left ſide, and the ball is to be adroitly placed beyond the root of the tongue, and immediately on quitting the ball, the tongue is to be let go, and the horſe allowed to raiſe his head. The ball is now in ſuch a ſituation that it cannot be thrown back, and will be gradually ſwallowed. In holding the tongue, it is proper to keep it pretty firmly againſt the lower jaw, as this poſition greatly facilitates the operation. Balls are uſually wrapt up lightly in paper, to prevent their diſagrecable taſte, but the paper ſhould be very thin and delicate, that it may eaſily give way when the ball enters the ſtomach. Wafer paper, which is employed for adminiſtering boluſes in the human ſubject, would be an improvement in farriery, which may be eaſily adopted, as it is by no means expenſive.

When the balls are compoſed of very hot or ſtimulating ingredients, it is proper to give the horſe drink before adminiſtering them. It is beſt to give the drink firſt, as horſes in particular will not readily drink after receiving a ball. If the ball has been compoſed of any medicine that poſſeſſes a corroſive quality, or is otherwiſe very irritating, as arſenic, corroſive ſublimate, blue vitriol, or the like, it is neceſſary to give the animal, previous to the operation, a conſiderable quantity of ſome mucilaginous drink, as of water-gruel, or linſeed tea.

When a ball is properly adminiſtered, it gives the animal very little fatigue, and may be repeated much more frequently than any other form of medicine. It is therefore extremely convenient.

The ingredients compoſing a ball ſhould be mixed up with ſome ſugary ſubſtance, as molaſſes, honey, or extract of liquorice ſoftened in water, rather than with any gummy or mucilaginous ſubſtance, as theſe latter ſoon become hard by expoſure to the air.

When a number of balls of the ſame kind are made at once, great care ſhould be taken in mixing the ingredients in the moſt accurate manner, otherwiſe a much greater quantity of the active part of the medicine will be found in ſome of the balls than in others.

Though we have mentioned the uſe of the balling iron, in adminiſtering balls to horſes, ſome grooms and farriers are very expert in giving the ball without this inſtrument.

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inſtrument. Where this can be done, it is certainly preferable, as the uſe of the iron is very apt to alarm a horſe.

Drenches.

254 Of drenches

This form is chiefly ſuited to thoſe remedies that are eaſily ſoluble in water, or which readily mix with that fluid, and which have not any very diſagreeable taſte. Hence all mucilaginous ſubſtances, ſome reſins, and many of the aromatics, may be given in this form. It is proper, in compounding a drench, that the ſubſtances compoſing it be thoroughly mixed with each other. It not unfrequently happens, that oils or balſams are given by way of drench, without any pains having been taken to combine them fully with the watery part of the medicine; and when ſubſtances that would admit of being finely powdered, are adminiſtered in this way, the careleſſneſs of grooms or farriers is too often ſuch as to give them in a very coarſe ſtate. In the former caſe the oil or balſam ſwimming in the liquid hangs about the mouth and throat of the animal, and by its unpleaſant taſte renders him averſe to the repetition of the medicine; in the latter caſe, it is evident that the remedy is not reduced to that ſtate in which it is capable of exerting its full effect.

255 Mode of adminiſtering.

Drenches are uſually adminiſtered by means of a horn, which is that of an ox or cow, with the larger end cut into the form of a ſpout. Sometimes when a horn is not at hand, a bottle is employed; but this is very improper, as in the horſe's ſtruggling, which often happens in adminiſtering a drench, the neck of the bottle may be broken, and occaſion much miſchief.

In giving a drench by means of the horn, the animal's tongue is to be held down with the left hand, as in giving a ball; and when his head is ſufficiently raiſed, the drench is to be poured cautiouſly into his mouth. Every ſtable ſhould be provided with a drenching horn.

In preparing drenches, farriers almoſt always make uſe of ale or beer, as the menſtruum or diluent; but this is often very abſurd, and can be proper only in the preparation of cordial drenches. Thoſe of a cooling nature ſhould be mixed, either with common water, or with ſome mucilaginous infuſion.

Drenches are ſeldom given with dexterity, and thus a conſiderable quantity of the medicine is frequently ſpilt. This circumſtance renders them often very inconvenient, particularly in caſes where there is any ſwelling or painful affection either of the mouth or throat. Under ſuch circumſtances it is ſcarcely adviſable to adminiſter medicine in the form of a drench; as, independently of the reſiſtance given by the horſe, which will certainly waſte much of the medicine, the forcing of a drench down his throat, when it is in an inflamed or irritable ſtate, may be followed by very unpleaſant conſequences. Mr Clark ſays that he has frequently obſerved a ſimple ſolution of nitre in water, ſweetened with honey or molaſſes, when given in caſes ſuch as we have deſcribed, to occaſion violent coughing, trembling and panting, inſomuch that the poor animal was like to drop down, merely from the acute pain he ſuffered, from a medicine being adminiſtered to him in the form of a drench at ſuch a critical period.

Even the poſition in which the horſe's head is placed to receive a drench may, in theſe caſes, excite the moſt violent pain, from the diſtention which the muſcles of the throat undergo, when the head and tongue are held in ſo awkward a ſituation. Materia Medica.

The great advantage of a drench is, that remedies exhibited in this form produce their effect much more ſpeedily than when given in the form of a ball, which may take a conſiderable time to be diſſolved in the juices of the ſtomach. Drenches are therefore particularly ſuited to urgent caſes, in which it is neceſſary to give immediate relief.

Clysters.

256 Of Clyſters.

This form is ſuited to a great variety of purpoſes, and is not adminiſtered ſo often as with propriety it might be given. Not only purges, which are very commonly adminiſtered in this way, but alſo every claſs of remedies, may be exhibited in the form of a clyſter. The clyſter ſhould be compoſed of no ſubſtances that are not either entirely ſoluble in water, or may be ſo thoroughly mixed with any watery fluid, as to paſs readily through a ſlender tube.

The inſtrument employed for adminiſtering a clyſter is, as in the human ſubject, a pipe and bladder, but the bladder ſhould be that of an ox, and of the largeſt ſize; to the extremity of which muſt be fitted a pewter pipe about a foot long, and about half an inch in diameter, having the extremity which is to enter the gut made completely ſmooth, that it may not injure the internal coat of the bowel.

257 Back-raking.

Previous to adminiſtering a clyſter, it is often neceſſary to free the great gut from a quantity of hardened excrement which it may contain. This is beſt performed by means of the hand, and the operation is called *raking*, or *back-raking*. The hand is eaſily introduced, as the diameter of the great gut is in the horſe very large. Care muſt be taken before introducing the hand, to greaſe it well with oil or hogs lard, and to have the nails cut perfectly cloſe, for fear of injuring the gut. This mode of extracting the hardened excrement is frequently required, and will ſucceed when medicine would probably only ſerve to increaſe the animal's diſtreſs.

258

Large ſyringes are frequently employed for the purpoſe of adminiſtering clyſters; but ſuch inſtruments are exceedingly improper, as their tubes are very ſhort, and they are very difficult to manage, eſpecially if the animal ſhould prove reſtleſs from pain, as frequently happens in caſes of colic; where, as we ſhall ſee, clyſters are very frequently required.

Clyſters are peculiarly requiſite in thoſe caſes where medicine cannot be conveniently given by the mouth; as in locked-jaw, or when there is any obſtruction in the throat, or wound of the tongue. In ſuch circumſtances horſes may frequently be kept alive for many weeks, by the frequent exhibition of nouriſhing clyſters.

Ointments.

259 Ointments.

Ointments are employed in farriery, merely as an application to ſores, or in ſome caſes of eruptions of the ſkin. They cannot be employed as in the human body, to introduce remedies into the ſyſtem; as on account of the hair that covers the body of quadrupeds,

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long-continued friction in this way cannot eaſily be employed.

Poultices.

260 Poultices.

Poultices are frequently employed, either for the purpoſe of maintaining a long-continued heat and moiſture about a part in which we are deſirous to produce ſuppuration, or for correcting the unpleaſant ſmell that ſometimes ariſes from foul ill-conditioned ulcers; or laſtly, they are applied to check inflammation. In the firſt caſe they are always applied warm, and ſhould be renewed repeatedly, till the proper effect is produced; as if old poultices are ſuffered to remain long on a ſuppurating part, they tend to check the ſuppuration inſtead of aſſiſting it. In the two latter caſes poultices are uſually applied cold.

Poultices ſhould always be compoſed of ſuch ſubſtances, as admit of being reduced to a ſoft maſs, either by boiling or pounding, as otherwiſe they would fret and irritate the parts to which they are applied. This muſt be particularly attended to in ſuch poultices as are laid over large open ulcers, or any part that is highly ſenſible.

Fomentations.

261 Fomentations.

Theſe are intended to relax and ſoften the parts to which they are applied, and in this circumſtance they nearly reſemble the firſt kind of poultices, only that fomentations are always in a liquid form, being compoſed of ſome infuſion or decoction of herbs. The mode of applying a fomentation is, by wetting a large flannel cloth in the warm liquor, wringing it ſlightly, and then applying it as warm as can eaſily be borne over the part to be fomented.

262 In the following liſt of the articles of the veterinary materia medica, we ſhall call the ſubſtances by thoſe names by which they are uſually known to the common people; but we ſhall add by way of ſynonyms the ſcientific names, as derived from the modern ſyſtems of natural hiſtory and chemiſtry. In fixing the doſes of each article, we ſhall, unleſs particularly mentioned to the contrary, only ſpecify the doſe proper for horſes and cattle; but it would be proper for the reader to keep in remembrance, that the doſe for a ſheep or a dog will be about one-half or one-third of that for a horſe or cow.

In claſſing the remedies we ſhall adapt the arrangement given in a late compendium of the materia medica. Moſt writers on the materia medica of horſes, have arranged their articles in alphabetical order. Mr White has done this, in his excellent veterinary materia medica and pharmacopeia. Such an arrangement does very well, if intended to anſwer the purpoſe of a dictionary; but for practice, it is better to have the articles claſſed according to the ſenſible effects which they appear to produce in the ſyſtem; as in this way the practitioner has before him all thoſe remedies that are of the ſame nature, and may ſelect from among them ſuch as he thinks will beſt ſuit the particular caſe that he has in hand.

It may be neceſſary to obſerve, that the weight intended in this part is troy weight divided according to the apothecaries, and the meaſure Engliſh wine meaſure.

1. Emetics.

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263 Emetics.

It will have appeared from our deſcription of the ſtomach of the horſe, that this animal is in general incapable of vomiting. Emetics, therefore, as calculated for him, form no part of the veterinary materia medica. We do not know that emetics are given either to ſheep or cattle, but to dogs they may be often given with advantage. A few ſubſtances, however, will anſwer this purpoſe, as in general a little graſs, or a little muſtard mixed with warm water, will be ſufficient to vomit a dog. The following ſubſtances may be ranked in this claſs for dogs.

a. Antimony. *Sulphuret of Antimony.*

Emetic Tartar. *Tartrate of Antimony and Potaſh.*

Doſe from two to four grains.

b. Antimonial Powder. *Oxide of Antimony with Phoſphate of Lime. James's Powder.*

Said to have been given with ſucceſs in the diſtemper.

Doſe from eight to ten grains, repeated every three or four hours, according to the evacuation produced.

c. Mercury.

Turbith Mineral. *Yellow Sulphate of Mercury.*

Uſed alſo for the diſtemper, and in caſes of recent poiſoning.

Doſe about half a drachm. Alſo recommended in canine madneſs.

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1. Take of turbith mineral, five grains;
   And emetic tartar, one grain.
   Give in a little milk after bleeding.

2. Expectorants.

265 Expectorants.

Theſe are remedies that are calculated to produce or keep up a diſcharge of mucus from the lungs, or windpipe, and are thus ſuited to relieve coughs and thickneſs of wind, or aſthma.

a. Ammoniac. *Gum Ammoniac.*

A gum-reſin. Doſe from three to five drachms, in the form of ball. Commonly combined with ſquill, or ſome other powerful expectorant, preceded by a purging medicine. Particularly ſuited to chronic coughs.

b. Asafoetida. *Ferula aſafœtida.* Lin.

A gum reſin; doſe about half a drachm, in a ball.

c. Balsam of Peru. *Myroxilon Peruiferum.* Lin.

Doſe from one to two drachms in combination in a ball, aſſiſted with other expectorants. In chronic coughs.

d. Balsam of Copaiva. *Copaifera balſamum.* Lin.

Doſe about an ounce, in the ſame form and caſes as the laſt.

e. Balsam of Sulphur.

Doſe from half an ounce to an ounce.

f. Barbadoes

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f. BARBADOES TAR. *Petroleum Barbadenſe.* Lin.
Employed ſometimes in chronic cough; but not ſo good as other expectorants.

g. GARLIC. *Allium ſativum.* Lin.
The cloves of the root beaten to a paſte; doſe from one to two ounces; made into a ball with liquorice powder, or boiled in water into a drench. In ſimilar caſes.

h. SQUILL. *Scilla maritima.* Lin.
Dried root powdered; doſe about a drachm, in a ball, with other mild expectorants.

i. STORAX. *Styrax officinale.* Lin.
Strained ſtorax. Doſe two drachms, in a ball. As a ſubſtitute for balſam of Tolu, in obſtinate coughs.

Receipts for Expectorants.

266 Receipts.

2. Take of gum ammoniac, three drachms;
Caſtile ſoap, two drachms;
Powdered ſquill, a drachm.
Mix with honey or molaſſes into a ball.

3. Take of camphor; powdered ſquill, each a drachm;
Balſam of copaiva, half an ounce;
Aromatic powder, two drachms.
With honey, mix into a ball.

4. Take of balſam of ſulphur, four ounces;
Barbadoes tar, two ounces;
Oil of aniſeſeed, two drachms;
Powdered liquorice root, enough to make a maſs, to be divided into balls, each weighing about an ounce and a half, for a doſe.

5. Take aſafœtida, half an ounce;
Powdered ginger, a drachm and a half;
Prepared ammonia, half a drachm;
Honey, &c. enough to make a ball.

3. SUDORIFICS.

267 Sudorifics.

Theſe are ſuch medicines as are intended, either to keep up or bring back the inſenſible perſpiration, or to excite profuſe ſweating. They are alſo called diaphoretics. See MATERIA MEDICA.

Few medicines are employed in farriery with a view to excite ſweat. In the dog, it is well-known that this effect can ſcarcely be produced by any means; and in the horſe it is found extremely difficult to produce any ſenſible ſudorific effect by means of medicine. This may indeed be excited by violent exerciſe and warm clothing; but theſe are ill ſuited to the caſes in which ſweating would be moſt deſirable. The inſenſible perſpiration may, however, be gently encouraged by ſome powerful ſweating medicines; and in cattle theſe may not unfrequently be given with advantage.

a. AMMONIA.
MINDERERUS's SPIRIT. *Acetate of Ammonia.*
Recommended by Mr White as a gentle diaphoretic. Doſe from eight to ten ounces in form of a drench. In febrile complaints.

b. CAMPHOR. *Laurus camphora.* Lin.
Doſe from one to two drachms, in form of a ball. In fevers.

c. ANTIMONY. *Sulphuret of Antimony.* Materia Medica.
Very commonly given to horſes for the purpoſe of improving the fineneſs of their coat. Doſe about an ounce, in powder mixed with the food.

d. EMETIC TARTAR. *Tartrate of Antimony and Potaſh.*
Doſe from one to two drachms; in a ball or drench.

ANTIMONIAL POWDER. *Oxide of Antimony with Phoſphate of Lime.*
Doſe about two drachms.

e. UNWASHED CALX or OXIDE of ANTIMONY.
Doſe two or three drachms, in compoſition as below.

f. NITRE. *Nitrate of Potaſh.*
Doſe about one ounce in a ball, with one or two drachms of camphor; or alone in a drench.

g. OPIUM. *Papaver ſomniferum.* Lin.
Seldom given alone, though it might probably be adminiſtered with great propriety, in doſes of two ſcruples to a drachm.

Receipts for Sudorifics.

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6. Take of nitre half an ounce;
Camphor, a drachm and a half;
Calomel, powdered opium, a ſcruple;
Molaſſes, enough to make a ball. In fever.

7. Take of unwaſhed calx of antimony, two drachms;
Camphor, a drachm;
Opium, half a drachm;
Compound powder of tragacanth, two drachms.
Honey enough to make a ball.
In fever. To be repeated occaſionally.

8. Take of emetic tartar from one drachm to two;
Compound powder of tragacanth, three drachms;
Honey enough to make a ball.

9. Take of emetic tartar, a drachm and a half;
Ginger, two drachms;
Camphor, half a drachm;
Opium, a ſcruple;
Oil of caraway, ten drops.
Molaſſes enough to make a ball.
For horſes that are hide-bound, and have unhealthy looking coats.

10. Take of antimonial powder, two drachms;
Caraway ſeeds powdered, half an ounce;
Ginger, a drachm;
Oil of aniſeſeeds, twenty drops.
Honey enough to make a ball.

11. Take of unwaſhed calx or oxide of antimony, two drachms;
Prepared ammonia, ginger, of each a drachm;
Opium, half a drachm;
Powdered aniſeſeeds, half an ounce;
Molaſſes, enough to make a ball.

4. DIURETICS.

269 Diuretics.

Theſe are remedies that are intended to produce a more than ordinary diſcharge of urine. See MATERIA MEDICA.

Diuretics

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Diuretics are frequently given to horſes, not only in caſes of dropſical ſwellings, eſpecially of the legs, but in greaſe, and in many eruptive diſeaſes; in running thruſhes, crack, or ulcers about the heels; in baldneſs of different parts of the body; and in ſome caſes where there appears to be a difficulty in ſtaling.

They are uſually given in the form of balls, but ſome of them by way of powder mixed with the food. Before exhibiting diuretics, bleeding is ſometimes requiſite. Theſe caſes will be ſtated in their proper place. It is alſo proper, during the uſe of diuretics, that the animal ſhould take regular exerciſe; and occaſional drink ſhould be given, to promote their operation. The uſe of them ſhould not be continued too long, as they are found to produce conſiderable weakneſs.

a. BALSAM of COPAIVA. See *Expectorants*.
This medicine, when given as directed under expectorants, frequently acts as a diuretic.

b. CAMPHOR. See *Sudorifics*.
Doſe about two drachms, mixed with nitre in a ball. In ſpaſmodic difficulty of ſtaling.

c. NITRE. *Nitrate of Potaſh.*
Doſe about one ounce, in the form of powder, ball, or drench. In fevers and ſtrangury.

d. POTASH. *Subcarbonate of Potaſh, or Vegetable Alkali.*
Doſe a drachm or two.

e. ROSIN.
Doſe from two to four drachms repeated occaſionally, in the form of powder with the food.
Roſin is a good diuretic in caſes of ſwelled legs and greaſy heels, but is ſeldom given, except to cart-horſes.

f. SOAP. *Caſtile Soap.*
Doſe from two to ſix drachms, in compoſition.

g. TOBACCO. *Nicotiana tabacum.* Lin.
Sometimes given by grooms for fining a horſe's coat.

h. TURPENTINE.
a. Common turpentine.
b. Venice turpentine. Doſe from half an ounce to an ounce; in the form of emulſion.

i. OIL or SPIRIT of TURPENTINE.
Doſe from one ounce to two.

Receipts for Diuretics.

12. Take of Caſtile ſoap, powdered roſin, of each three drachms;
Nitre, half an ounce;
Oil of juniper, a drachm.
Firſt beat the ſoap and oil of juniper together, and then add the other ingredients, to make a ball.

13. Take of nitre in powder, half an ounce;
Camphor, oil of juniper, of each one drachm;
Caſtile ſoap, three drachms.
Rub the camphor and oil together, then add the ſoap and nitre, and as much flour as is ſufficient to make it into a ball.

Take of roſin and nitre, each half an ounce.
Mix into a powder, to be taken with the food.

5. PURGES.

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270 Purge.

Theſe medicines are well known. They are generally conſidered of two kinds; laxatives, or ſuch as gently move the bowels, and are intended merely to empty them of excrement; and purges, or ſuch as, beſides this effect, are intended to ſtimulate the exhalent veſſels of the inteſtines, and produce a conſiderable diſcharge of liquid ſtools, (See MATERIA MEDICA. As either order may in general be given ſo as to produce either of theſe effects, according to the quantity in which it is adminiſtered, we ſhall conſider them together.

Purgative medicines are given with conſiderable advantage to all the domeſtic animals, in many caſes of diſeaſe, which will be pointed out hereafter. They are very commonly, however, given to horſes, by grooms and ordinary farriers, by way of alterative or preventive of diſeaſe; or in order, as they think, the better to prepare them for ſome unuſual exertion. The reaſon given for this practice is, that the horſe is foul in the body, or full of humours, and the purgatives are given to expel this morbid accumulation of humours.

271 Impropriety of indiſcriminate purging in horſes.

"This ſort of evacuation (ſays Dr Bracken, who is one of the firſt that pointed out the abſurdity of this practice), ſeems very much to quadrate with the outward ſenſes, and makes the ignorant part of mankind, whoſe heads are fuller of humours than their horſes, imagine that purging medicines carry off the offending matter in moſt diſorders; never conſidering the general rule, which ought ſtill to be kept in mind, viz. that in proportion to any one evacuation being heightened or increaſed, moſt or all of the other natural evacuations are proportionally diminiſhed.

It muſt be remembered that the inteſtines of the horſe are exceedingly long, and the large inteſtines are ſo conſtructed as in many caſes to retain the food or excrement for a very conſiderable time. Purgative medicines given to a horſe are often retained for 24 or 30 hours; and if theſe have been of an irritating quality, it is evident that the unneceſſary exhibition of them may often produce conſiderable miſchief. Mr Blaine ſays, that when horſes die after the exhibition of ſtrong purges, which according to him is not unfrequently the caſe, he has always found the large inteſtines more or leſs inflamed.

It is found that after giving a horſe a ſtrong purge, he is often incapable of returning to his uſual work for many days; it is even ſaid for a month. Hence it will eaſily appear how abſurd is the practice of thoſe who phyſic their horſes without neceſſity. Mr John Lawrence is, however, ſtill an advocate for purging horſes now and then, and is of opinion that the miſchief done by purges is to be attributed to the coarſeneſs of the medicine, rather than to its purging effect. He declares, that after 30 years experience, he has never known purging do harm, if the aloes employed was of the finer ſort.

Veterinary practitioners differ with reſpect to the time of adminiſtering a purge. Mr Blaine recommends it to be given in the morning, when the horſe is to be allowed to faſt from 9 or 10 o'clock to 12 or 1. Then a lock or two of hay, or about two handfuls, is to be given him, and after this he is to have the ball, with a

horn

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horn full of warm ale, or water-gruel, immediately after it. He is then to faſt for another hour, when he is to be allowed the moderate uſe of hay. He ſhould have all his drink a little warm; ſhould be walked about gently during the remainder of the day, and ſhould have a warm maſh at night. Next day he is to be again moderately exerciſed at intervals, till the purge begins to operate; but if the weather is ſevere, he muſt be covered with body clothes, and care muſt be taken not to have the ſtable too warm when he returns. Mr Clark recommends a maſh of bran to be given about an hour before the ball, and ſays that in this way he has always found the medicine to operate in a gentle and eaſy manner.

272 Strong exerciſe before purging, improper.

It is a common practice with many people to ride their horſes very hard before giving them a purging medicine, with the view, as they term it, to ſtir up the humours, which being thus ſet afloat, will more eaſily be carried off by the purge. To ſay no more with reſpect to the abſurdity of the doctrine, we may remark that the practice itſelf is highly dangerous, as a purge adminiſtered after ſuch violent exerciſe, will ſeldom fail to produce inflammation in the bowels, fevers, or ſome other diſorder, which, though it may not at the time prove fatal, may lay the foundation of blindneſs, incurable lameneſs, or ſome other diſorder that may render the horſe uſeleſs. Violent exerciſe, after adminiſtering a purge, is equally to be avoided, as it may produce ſweating, and thus counteract the purgative effect; or, what is as bad, it will tend to increaſe the weakneſs that ſeldom fails to be brought on by purging.

We have been the more particular in our obſervations on purging horſes, as it is a matter of conſiderable conſequence, and as the effect of indiſcriminate purging in this animal is little underſtood.

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a. ALOES. *Aloe perfoliata.* Lin.

a. Socotorine aloes. Doſe from five to nine drachms.
b. Barbadoes aloes. Doſe from half an ounce to an ounce.

Of theſe the latter is commonly employed for horſes. It is beſt given in form of a ball, mixed with ſoap, as preſcribed at preſent. In moſt caſes where purges are required.

b. CASTOR OIL. *Ricinus communis.* Lin.

Doſe from a pound to a pound and a half. In fevers and worms. Though Mr White ſays, he has given it in the latter caſe without effect.

c. EPSOM SALT. See SULPHATE *of Magneſia.*

d. GAMBOGE. *Stalagmitis cambogioides.* Lin.

Seldom employed in horſes, though recommended by Mr White as a uſeful medicine in worms.

Doſe from two to three drachms, in a ball with Caſtile ſoap.

e. JALAP. *Convolvulus jalapa.*

Doſe in the dog twenty to thirty grains.

f. COMMON SALT. *Muriate of Soda.*

Doſe from four to ſix ounces in a drench, or in a larger doſe by way of clyſter.

g. SOAP.

Chiefly uſed to combine aloes and other purgatives into a ball. Materia Medica.

h. MERCURY, or *Quickſilver.*

i. CALOMEL. *Sub-muriate*, or *mild muriate of mercury.*

Doſe from one to two drachms, uſually mixed with other purgatives.

In liver complaints, obſtinate caſes of greaſe, chronic inflammation of the eyes, and dropſical ſwellings of the hind-legs.

k. GLAUBER'S SALT. *Sulphate of Soda.*

Doſe about a pound. Beſt given in the form of a clyſter. In fevers, and inflammatory complaints.

l. EPSOM SALT. *Sulphate of Magneſia.*

As the laſt.

Receipts for Purges.

274 Receipts.

14. Take of Socotorine aloes, five drachms;
Caſtile ſoap, half an ounce;
Oil of caraway, ten drops;
Molaſſes enough to make a ball.

A moderate doſe for young or delicate horſes.

15. Take of Socotorine aloes, an ounce;
Caſtile ſoap, half an ounce;
Calomel, a drachm and a half;
Oil of mint, twenty drops;
Molaſſes enough to make a ball.

16. Take of Barbadoes aloes, half an ounce;
Compound powder of tragacanth, two drachms;
Salt of tartar, a drachm and a half;
Syrup enough to make a ball.

This is given as a laxative by Mr White, who declares that he never ſaw any ill reſult from giving Barbadoes aloes, though Mr Blaine and Mr Lawrence are of opinion, that Socotorine aloes is always to be prefered.

17. Take of water-gruel, a gallon;
Glauber's ſalt, half a pound;
Oil of olives, or linſeed oil, a pint.

To be given warm by way of clyſter. In fevers and inflammations of the bowels.

18. Take of powdered jalap, a drachm;
Powdered ginger, half a drachm;
Syrup of buckthorn, enough to make a ball.

For dogs.

6. ERRHINES.

275 Errhines.

Theſe remedies are ſuited to produce a conſiderable diſcharge from the noſtrils, and with this view are ſometimes preſcribed to horſes in caſes of ſtaggers or violent headaches. They muſt, however, be given with caution, and not till after bleeding and other evacuating means have been uſed. They are always adminiſtered in the form of powder, which is blown up the noſtrils, uſually through a quill.

a. ASARABACCA. *Aſarum Europæum.* Lin.

The dried leaves in powder.

The ſnuff, uſually ſold by the name of cephalic ſnuff, is chiefly compoſed of aſarabacca mixed with ſome aromatic

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aromatic herbs, and will anſwer the purpoſe of an errhine pretty well.

b. Tobacco.
Common ſnuff.
In affections of the eyes.

7. Sialogogues.

276 Sialogogues.

Theſe remedies are given with a view of increaſing the flow of ſaliva or ſlaver. They are ſeldom employed in veterinary medicine, though it is probable that ſalivation might be productive of good effects in the locked jaw, ſo fatal to horſes, and in the *diſtemper* in dogs.

a. Ginger. *Amomum zingiber.*
Sometimes tied about a horſe's bit by way of a maſticatory, as it is called.

b. Mercury.
Calomel is the only mercurial that can properly be employed to excite ſalivation in the horſe and dog; and it will ſcarcely produce this effect, if given by the mouth. It is beſt to rub the gums with it twice or thrice a day, till the proper effect is produced. See Stimulants.

8. Emollients.

277 Emollients.

Theſe are ſuch remedies as are calculated, either to relax the body, or to abate acrimony. The former are ſometimes divided into diluents and relaxants; the latter are uſually called demulcents, although diluents are alſo commonly given to obviate acrimony.

a. Barley. *Hordeum diſtichon.* Lin.
The uſe of barley as an article of food, has been already noticed. A decoction of it forms a part of moſt emollient drenches and clyſters.

b. Chamomile. *Anthemis nobilis.* Lin.
The dried flower. In infuſion or decoction by way of fomentation.

c. Gum Arabic. *Mimoſa nilotica.* Lin.
In powder. Doſe two or three ounces or more, by way of a drench.

d. Gum Dragant. *Aſtragalus tragacantha.*
In infuſion, ſo as to form a mucilage. In inflammatory affections of the lungs, bowels, or bladder.

e. Hog's Lard.
An ingredient in moſt ointments and liniments.

f. Lintseed. *Linum uſitatiſſimum.* Lin.
In infuſion, by way of drench or clyſter. In purging or ſcouring.

g. Liquorice. *Glycyrrhiza glabra.* Lin.
The root in infuſion, or the powder.
Seldom employed except to render drenches more palatable, or in powder to mix up balls.

h. Marshmallows. *Althea officinalis.* Lin.
The dried root in decoction, by way of drench or clyſter. In internal inflammations, or irritation from ſtrong purges.

i. Olive Oil.
A principal ingredient in ointments and liniments, and alſo frequently given by way of drench or clyſter.

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k. Starch.
Very ſerviceable by way of clyſter diſſolved in warm water, either to obviate acrimony in inflammation of the bowels, and ſcouring; or by way of nouriſhment, combined with a little opium, in caſes where food cannot be given by the mouth.

l. Warm Bath.
Seldom employed, on account of its inconvenience, although it would be probably one of the beſt remedies in ſpaſmodic complaints.

Receipts for Emollients.

278 Receipts.

19. Take of lintſeed, four ounces;
Boiling water, three pints.
Infuſe for ſome hours, and add to the ſtrained liquor of nitre an ounce, honey ſufficient to make a palatable drench. For two doſes.

20. Take of marſhmallow root ſliced, four ounces;
Water three pints.
Boil together till the liquor be reduced to a quart, and to the ſtrained decoction add of
Powdered gum arabic an ounce;
Lintſeed oil two ounces;
Honey ſufficient to make it palatable. For two doſes.
The above decoction, before the other ingredients are added, forms a good emollient fomentation.

21. Take of ſtarch, two ounces;
Water-gruel, two quarts;
Mix for a clyſter.
To be given frequently in ſcouring or purging.
If they are not kept up for a ſufficient time, two or three drachms of laudanum muſt be added.

9. Cooling Remedies.

279 Cooling remedies.

Theſe are called refrigerants by medical writers, and it is ſuppoſed that they act by diminiſhing the temperature of the body. See Materia Medica. They are peculiarly ſuited to caſes of fever and inflammation.

a. Nitre.
Frequently employed in fevers and inflammations, except thoſe of the kidneys, and in catarrh. Doſe about an ounce, diſſolved in water-gruel, or ſome mucilaginous decoction, by way of a drench.

b. Sal Ammoniac. *Muriate of Ammonia.*
Externally, as a lotion againſt inflammation.

c. Spirit of Salt. *Muriatic acid.*
May be employed as a refrigerant in fevers, when largely diluted with water, or water-gruel.

d. Sugar of Lead. *Acetate of Lead.*
Employed externally, diſſolved in ſoft water; by way of lotion or embrocation, for ſtrains or bruiſes; and in the form of a poultice with oat-meal, to check inflammation.

e. Goulard's

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e. GOULARD's EXTRACT, or *Vegeto-mineral water.* Is merely another form of the ſame remedy.

f. VINEGAR. *Acetous acid.* Employed externally in ſimilar caſes.

g. VITRIOLIC ACID. *Sulphuric acid.* Uſeful in ſimilar caſes with the muriatic acid, but requires to be largely diluted.

280 Receipts.

Receipts for Cooling Remedies.

22. Take of nitre, one ounce;
Emetic tartar, two drachms.
Diſſolve it in a ſufficient quantity of water-gruel, for a drench.

23. Take of ſugar of lead, half an ounce;
Vinegar, two ounces;
Rain-water a quart.
Diſſolve for a lotion.

24. Take of ſal ammoniac, an ounce;
Vinegar, four ounces;
Spirit of wine, two ounces;
Soft water, half a pint.
Diſſolve for a lotion.
Both theſe lotions are employed in external inflammation.

25. Take of cream of tartar, two drachms;
Nitre, an ounce;
Water-gruel, a quart.
For a drench in fevers.

26. Take of emetic tartar, a drachm;
Glauber's ſalt, eight ounces;
Water-gruel, a quart.
In ſimilar caſes attended with coſtiveneſs.
To be repeated every ſix hours.

27. Take of extract of lead, half an ounce;
Diſtilled vinegar,
Olive oil, of each two ounces.
Mix well together, into a liniment.
For ſore backs.

28. Take of marſhmallow ointment, half a pound;
Sugar of lead rubbed fine, an ounce.
Mix for an ointment.

281 Aſtringents

10. ASTRINGENTS.

Aſtringents are ſuch medicines as are ſuppoſed to produce a degree of rigidity in the muſcular fibres, and thus to increaſe its power of action, or to prevent morbid diſcharges. Such as are intended to prevent unuſual diſcharges of blood are called ſtyptics. For the action of aſtringents, ſee MATERIA MEDICA.

a. ALUM. *Superſulphate of Alumina and Potaſh.*
In powder, from half an ounce to an ounce, in the form of drench or ball.
In purging, diabetes, &c. Externally by way of lotion, or in a fine powder ſprinkled on the part. In greaſe.

b. BISTORT. *Polygonum biſtorta.* Lin.
The root in powder, from half an ounce to an ounce; or in a larger doſe, in the form of decoction, for a drench.
A powerful aſtringent in caſes of purging, and recommended in hemorrhages.

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c. GALLS. *Quercus cerris.* Lin.
Nut galls.
In powder, infuſed in boiling water as an external application.

d. IRON. *Muriate of Iron.*
A powerful aſtringent, though rarely employed in veterinary practice. It may be given in caſes of obſtinate purging, or diabetes, in doſes of a drachm or two, by way of drench.

e. JAPAN EARTH. *Mimoſa catechu.*
Improperly called an earth, as it is a vegetable extract. Given in powder, from two drachms to four, in purging and diabetes.

f. KINO.
An extract ſimilar to the former, and adapted to ſimilar purpoſes.

g. LOGWOOD. *Hæmatoxylon Campechianum.* Lin.
Extract of logwood. Doſe from two to four drachms in a ball.

h. OAK BARK. *Quercus robur.* Lin.
In powder. Doſe about two ounces, in the form of a ball. Externally by way of decoction.

i. POMEGRANATE. *Punica granatum.* Lin.
The dried fruit in powder. Doſe from half an ounce to an ounce. Chiefly given in the ſcouring incident to horned cattle.

k. TORMENTIL. *Tormentilla erecta.* Lin.
The root in the form of decoction, by way of a drench. An ounce or an ounce and a half in three pints of water, boiled to a quart. In ſimilar caſes with the laſt.

l. VITRIOLIC ACID. *Sulphuric Acid.*
Diluted Vitriolic Acid.
Uſed externally by way of lotion, in obſtinate caſes of greaſe, and to foul ulcers. Not given to the horſe internally.

m. ZINC.

WHITE VITRIOL. *Sulphate of Zinc.*
Chiefly employed externally, in inflammations of the eye, and as a lotion to foul ulcers, and to check inflammation. Seems to have little effect on the horſe, but may probably be given to cattle with ſome advantage in caſes of debility.

Receipts for Aſtringents. 282 Receipts.

29. Take of powdered oak bark, an ounce;
Powdered ginger, two drachms;
Opium, a drachm;
Solution of glue, enough to make the maſs into a ball.
In profuſe ſtaling, with a drench of oak-bark decoction after it.

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30. Take of kino, two drachms;
Alum, half an ounce;
Ginger, a drachm;
Caſtile ſoap ſoftened with water, two drachms;
Powder of oak-bark, enough to make a ball.
In ſcouring or purging.

31. Take of white vitriol,
Sugar of lead, each one drachm;
Soft water, half a pint.
Mix.
For eye-water, in inflammation of the eyes.

283 Strengthening remedies.

11. Strengthening Remedies.

Theſe are commonly called tonics by medical writers. Many of them are aſtringents, and have been already enumerated.

a. Galangal. *Maranta galanga.* Lin.
The root in powder; doſe about an ounce. In weakneſs of the ſtomach.

b. Gentian. *Gentiana lutea.* Lin.
The root in powder; doſe from half an ounce to ſix drachms.

Extract of Gentian. Doſe, a drachm or two, in a ball in compoſition. In indigeſtion and weakneſs of the ſtomach.

c. Horse Chesnut. *Eſculus hippocaſtanum.* Lin.
The bark in powder, or its decoction. Doſe of the powder about an ounce.

d. Iron.

Salt of Steel. *Sulphate of Iron.*
Doſe about half an ounce. Generally in compoſition. In ſimilar caſes.

e. Myrrh.
A gum reſin. Doſe in powder, from two to four drachms, in a ball. In weakneſs of the ſtomach, and general debility.

f. Oak Bark. *Quercus robur.* Lin.
Doſe in powder about an ounce.
In general debility, ſucceeding to violent diſeaſes.

g. Peruvian Bark. *Cinchona officinalis.* Lin.
Doſe of the powder from one ounce to two. Seldom employed in veterinary practice on account of its expence. Said to be inferior to many other tonics in the horſe.

h. Quassia. *Quaſſia excelſa.* Lin.
The wood and the bark of the root. Doſe in powder two or three drachms, in a ball, or infuſed in water by way of a drench.

i. Blue Vitriol. *Sulphate of Copper.*
Recommended as a powerful tonic, but requires caution in its uſe. Doſe about half a drachm, gradually increaſed according to its effects. A conſiderable quantity of drink ſhould be given, either before or after it.
In caſes of debility that reſiſt other tonics.

Receipts for Tonics.

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32. Take of powdered gentian, half an ounce;
Ginger, two drachms;
Honey or molaſſes, enough to make a ball.

33. Take of powdered horſe chesnut bark, an ounce;
Myrrh, in powder,
Caſtile ſoap, each a drachm;
Water, enough to make a ball.

34. Take of powdered caſſia buds, a drachm;
Extract of gentian, a drachm and a half;
Honey, enough to make a ball.

35. Take of powdered oak bark, an ounce;
Aromatic powder, two drachms;
Salt of tartar, a drachm;
Molaſſes, enough to form a ball.

36. Take of ſalt of ſteel, two drachms;
Infuſion of quaſſia, (2 drachms to a quart of water) a quart;
Diſſolve for a drench.

285 Stimulants.

12. Stimulants.

Theſe are ſuch remedies as are ſuited to increaſe the action, either of the whole circulating ſyſtem, or of ſome particular part or organ. They are at preſent uſually divided into *diffuſible* and *permanent*, the former being ſuch as produce a conſiderable ſtimulating effect, which is ſoon followed by a degree of quietneſs or torpor, proportioned to the quantity that had been adminiſtered; as wine, alcohol, ether, and probably opium; the other ſort being ſuch as produce no very conſiderable effect, unleſs repeatedly exhibited for ſome conſiderable time.

Moſt of the ſtimulants are called *cordials* or *aromatics;* and under this claſs, we rank thoſe medicines which have been called *carminatives*, or which are calculated to expel wind from the ſtomach and bowels. *epiſpaſtics* or bliſtering ſubſtances; and under this claſs we may alſo reckon moſt of thoſe remedies that are called *alteratives*, or ſuch as are ſuppoſed to produce ſome change in the conſtitution or habit of body. The ſtimulating remedies employed in farriery, as in human medicine, are very numerous.

a. Ammonia, or *Volatile Alkali. Prepared Ammonia. Carbonate of Ammonia.*
Doſe from half a drachm to two drachms, in a ball newly prepared. In the latter ſtages of fever, attended with great debility.

b.——— *Spirit of Sal Ammoniac. Water of Carbonate of Ammonia.*
Chiefly uſed externally.
Cauſtic Volatile Alkali. Water of Ammonia.
Uſed externally mixed with oil into a liniment, in caſes of ſtrains, bruiſes and ſwellings of the back ſinews.

c. Aniseseed. *Pimpinella aniſum.* Lin.
The ſeed in powder. Doſe about an ounce, in a ball.
Eſſential oil of aniſeeed.
Doſe from half a drachm to a drachm, in the ſame form. In flatulency and indigeſtion.

d. Balsam

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d. BALSAM OF COPAIVA. See *Expectorants.*
In flatulent colic or gripes.

e. BARBADOES TAR.
Externally mixed with oil of turpentine or fweet oil into an embrocation. In ftrains and bruifes.

f. CANTHARIDES, or *Spanifh fly. Lytta veficatoria.*
Tincture of cantharides. Externally by way of embrocation in fimilar cafes.

Blifters are well known to be thofe remedies that irritate the fkin to which they are applied, fo as to raife the fcarf-fkin into a bladder containing a watery fluid, which is the ferous part of the blood. By abftracting this from the general mafs of circulation, they produce an evacuation, proportioned to their extent, from the part to which they are applied, and are thus extremely ufeful in producing a determination of blood from fome neighbouring and more important part.

Blifters are of confiderable ufe in veterinary practice. According to Mr White they are very efficacious in difperfing callous fwellings, the effects of ftrains, bruifes, &c. Their beneficial effects are very great in removing the inflammation of fuch parts as are remote from the furface. In inflammations of the internal parts of the foot, they generally give relief when applied to the paftern, efpecially if the auxiliary remedies are not neglected, fuch as rafping the hoof, paring the fole, foaking the horny part of the foot in warm water, or by the application of a poultice to it, and adminiftering a purging medicine. For curbs, wind-galls, fpavins, &c. no remedy is more efficacious than blifters. It is alfo productive of falutary effects in inflammation of the internal organs. For inftance, when the lungs are inflamed, the determination of blood to the difeafed part is leffened by extenfive blifters of the fides, and confiderable relief is afforded in this way.

By the unfkilful treatment of broken knees, a callous fwelling is often left in the part, for the removal of which it is always neceffary to have recourfe to blifters. If blifters are freed from all cauftic ingredients, and properly made, no injury to the hair will refult from their application; and if one fhould fail of producing the defired effect, the practice may be followed without danger till that object is attained.

g. BLUE VITRIOL. *Sulphate of Copper.*
Employed externally to foul ulcers, either in folution, or by touching their edges with a cryftal of it; to produce healthy granulations. Alfo in fome inflammations of the eye by way of lotion.

h. BURGUNDY PITCH.
As an ingredient in ftimulating ointments and plafters.

i. CAPSICUM, or CAYENNE PEPPER. *Cap. annuum.* Lin.
The dried pod in powder.
Dofe about a drachm, in a ball, with milder ftimulants. In flatulence and indigeftion,

k. CARAWAY. *Carum carui.* Lin.
The feeds and their effential oil.
Dofe of the oil from half a drachm to a drachm, in a ball, as prefcribed prefently. In weaknefs of the ftomach, flatulence, and indigeftion.

l. CASSIA. *Laurus caffia.* Lin.
The bark and flowering buds in powder.
Dofe, from one to three drachms. Ufed as an ingredient in many cordial medicines. Chiefly for affections of the ftomach.

m. CLOVES. *Eugenium caryophyllata.* Lin.
The flowering buds.

n. OIL OF CLOVES.
Dofe, 20 or 30 drops. In gripes and ficknefs of the ftomach.

o. CUMMIN. *Cuminum cyminum.* Lin.
The feeds and their effential oil.
In a dofe of from half a drachm to a drachm, in fimilar cafes.

p. OIL OF CUMMIN.
Dofe, from half a drachm to a drachm. In flatulent colic.

q. FENNEL. *Anethum fœniculum.* Lin.
The feeds in powder.
Dofe, an ounce or two.

r. GINGER. *Amomum zingiber.* Lin.
The root in powder. One of the moft ufeful ftimulants, and preferable to moft others in veterinary practice.
Dofe, a drachm or two. In weaknefs of the ftomach, indigeftion, and flatulent colic.

s. GRAINS of PARADISE. *Amomum grana paradifi.* Lin.
The feeds. Chiefly employed as a ftimulant for cattle, as a cordial.
Dofe, from three to fix drachms.

t. WHITE HELLEBORE. *Veratrum album.* Lin.
The root in powder. Chiefly ufed externally in blifters, and for difeafes of the fkin. Formerly employed as a purge for horfes, but now deervedly exploded, as by far too violent.

u. HORSE RADDISH. *Cochlearia armoracia.* Lin.
The frefh root in infufion or diftilled water. In flatulence and indigeftion.

v. MERCURY.
Calomel. Dofe, from 15 grains to half a drachm. In farcy, glanders, &c.
Wherever calomel or other mercurial preparations are given, the animals fhould be kept warm, fhould drink their water a little warmed, and fhould take regular exercife in dry weather.

w. CORROSIVE SUBLIMATE. *Muriate of Mercury.*
Employed internally in folution, in dofes of about 15 grains, gradually increafed. In farcy and glanders. Externally by way of lotion, to foul ulcers and eruptions of the fkin.
No preparation of mercury feems to produce fo great a degree of weaknefs in the horfe as this. Its effects muft therefore be carefully watched; and befides the regulations laid down above; the horfe muft be kept on a more nourifhing diet than ufual.

x. RED PRECIPITATE. *Nitrated Oxide of Mercury.*
Externally to ulcers, either fprinkled on their furface,

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or mixed into an ointment; in which latter form it is very useful in chronic inflammation of the eyes.

y. NITRATE OF MERCURY. See *Receipts*, N° 49.

z. MINT. *Mentha ſativa*, Lin.
The eſſential oil.
Doſe, about a drachm. In weakneſs of the ſtomach, &c.

a a. MUSTARD. *Sinapi nigrum.* Lin.
The ſeed in powder.
Externally mixed with water into a paſte, or ſinapiſm, in caſes of internal inflammation.

b b. PEPPERMINT. *Mentha piperita.* Lin.
The eſſential oil.
Doſe, about half a drachm. In ſimilar caſes with mint.

c c. PEPPER. *Piper nigrum.* Lin.
Doſe, from half an ounce to an ounce, in powder. In flatulent colic.

d d. SPIRITS. *Whiſky, Gin, or Brandy.*
Doſe, from a gill to half a pint. To cattle in the flatulence proceeding from eating too much green food.

e e. SALT. *Muriate of Soda.*
Given with good effect to ſheep in the rot.

f f. TAR.
Commonly given by country farmers to cattle when hoven from clover.

g g. TURPENTINE.
Oil of Turpentine.
Doſe, an ounce or two. In flatulent colic. Externally by way of embrocation. In caſes of indurated ſwellings, ſtrains, and bruiſes; and for cattle after the bite of the gad-fly.

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Receipts for Stimulants.

Cordial Balls.

37. Take of caraway ſeeds powdered, ſix drachms;
Powdered ginger, two drachms;
Oil of cloves, 15 drops;
Treacle enough to make a ball.

38. Take of powdered aniſeſeeds, half an ounce;
Turmeric, an ounce;
Powdered caſſia, two drachms;
Treacle enough to form the ball.

39. Take of caraway ſeeds, and grains of paradiſe, each in powder, three drachms;
Ginger, a drachm;
Oil of mint, 30 drops;
Honey enough to form the ball.

Stimulating Ointments and Liniments.

40. Take of yellow baſilicon, half a pound;
Red precipitate finely ground, two ounces;
Mix well together.
For foul ulcers.

41. Take of hog's lard four ounces;
Oil of turpentine, an ounce.
Melt together on a ſlow fire.
In ſimilar caſes.

42. Take of oil of turpentine,
Oil of olives, each two ounces.
Mix for a liniment.
For ſtrains and bruiſes.

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43. Take of verdigriſe finely powdered, an ounce;
Venice turpentine, half an ounce;
Olive oil, an ounce.
Melt the turpentine and oil together, and when nearly cold, add the verdigriſe.
For foul ulcers.

44. Take of hog's lard, four ounces;
Bees wax, an ounce;
Venice turpentine, three ounces;
Red precipitate finely ground, two ounces.
Melt the three firſt together, and when nearly cold, ſprinkle in the powder.

This is Mr White's receipt for the digeſtive ointment, commonly employed by farriers for dreſſing rowels and ulcers.

45. Take of camphor, an ounce;
Oil of turpentine, two ounces;
Rectified ſpirit, four ounces.
Diſſolve. For old ſtrains.

Stimulating Lotions.

46. Take of blue vitriol, an ounce;
Water, four ounces;
Vitriolic acid, 10 drops.
Mix.
For ſimilar caſes, and for the mange.

47. Take of blue vitriol, half a drachm;
Water, half a pint.
Diſſolve for a lotion.
In inflammation of the eyes.

48. Take of tincture of opium, two ounces;
Water, ſix ounces.
Mix for an eye water.
In ſimilar caſes.

49. Take of aquafortis, two ounces;
Quickſilver one ounce.
Diſſolve in a gentle heat, taking care to avoid the fumes.

This forms a *nitrate of quickſilver*, and when diluted with a proper quantity of water, is one of the beſt applications for the foot-rot in ſheep.

13. ANTISPASMODICS.

287 Antiſpaſmodics.

Theſe are ſuch remedies as are calculated to remove ſpaſmodic affections of the muſcles, or convulſive affections, and are therefore frequently employed in caſes of locked jaw, epilepſy, &c. Few remedies of this claſs are uſed in veterinary practice. Such as are more peculiarly of this nature are mentioned below. They generally conſiſt of ſtimulants or of anodyne remedies.

a. CAMPHOR.
Doſe, about two drachms, in a ball combined with opium and ſtimulants. In locked jaw.

b. ETHER. *Sulphuric Ether.*
One of the moſt powerful antiſpaſmodics.

Doſe,

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Doſe, about an ounce, mixed with a pint of water. This ſhould be given as expeditiouſly as poſſible, otherwiſe much of the ether will evaporate. In obſtinate caſes of flatulent colic.

c. Opium.
Doſe a drachm or two. The latter quantity generally in clyſters.

Tincture of Opium.
Doſe, from half an ounce to an ounce, repeated occaſionally, in moſt ſpaſmodic complaints.

Oil of Turpentine.
Doſe, about two ounces. In flatulent colic.

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Receipts.

50. Take of camphor, a drachm;
Eſſence of peppermint, two drachms.
Grind together, and add
Of water, a pint;
Ether, half an ounce.
Mix.
To be given immediately.
In violent cramp of the ſtomach.

51. Take of tincture of opium, an ounce;
Oil of juniper, two drachms;
Dulcified ſpirit of nitre, a drachm;
Water, a pint.
Mix.

52. Take of tincture of opium, two ounces;
Cold water-gruel, a quart.
For a clyſter.
To be repeated frequently.
In locked jaw.

289 Anodynes.

14. Anodynes

Are thoſe remedies which are given for the purpoſe of procuring ſleep, or alleviating pain. They are commonly called *narcotics*, and many of them are by moſt medical writers denominated *ſedatives*.

a. Fox-Glove. *Digitalis purpurea.* Lin.
The leaves in powder.
Doſe, half a drachm, increaſed gradually according to its effect. In violent internal inflammations and ſwelling of the legs.

b. Hemlock. *Conium maculatum.* Lin.
Leaves in powder.
Doſe, about a drachm, gradually increaſed.

Extract of Hemlock.
Doſe, about a drachm.
In obſtinate coughs attended with irritability.

c. Henbane. *Hyoſcyamus niger.* Lin.
The leaves in powder, or the ſeeds.
Doſe, about a drachm.

Extract of Henbane.
Doſe, about a drachm.
A ſolution of this extract has been found uſeful, applied to the eye, in chronic inflammation.

d. Hop. *Humulus lupulus.* Lin.
The dried cones in powder.

Doſe a drachm or two, in a ball.
The hop has been ſhewn to be a powerful narcotic, and has ſucceeded in producing ſleep in ſome caſes where opium has failed. It has not yet been introduced into veterinary practice; but we think it deſerves a trial, as being much cheaper than opium.

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e. Opium.
Doſe, about a drachm by the mouth, and two drachms in a clyſter.

f. Poppy. *Papaver ſomniferum.* Lin.
The dried heads boiled in water, by way of fomentation.

290 Receipts.

Receipts.

53. Take of opium, a drachm;
Powdered aniſeſeeds, half an ounce;
Caſtile ſoap, two drachms;
Molaſſes, enough to make a ball.

54. Take of camphor, a drachm and a half;
Opium, a drachm;
Ginger, two drachms;
Honey, enough to form the ball.

55. Take of tincture of opium, two drachms;
Decoction of poppyheads, a quart.
Mix for a clyſter.

56. Take of extract of hemlock, two drachms;
Peppermint water, half a pint;
Ether, half an ounce.
Diſſolve the extract in the water, and add the ether at the moment of exhibition.
For a drench.
In putrid fever, or gangrene.

57. Take of bruiſed poppyheads, four ounces;
Hemlock leaves green, a large handful.
Boil gently in a gallon of water for about an hour, and ſtrain the decoction.
In wounds and bruiſes attended with conſiderable irritability.

291 Worm medicines.

15. Worm Medicines.

There are few caſes in which worm medicines are given in veterinary practice. In the horſe they are ſeldom required, and do not often prove effectual. In the dog, indeed, they have been employed more frequently, and may be uſed with more probability of ſucceſs. The remedies of this claſs are generally of two kinds, either ſuch as are violent purgatives, and in this way expel the worms by the violence of their operation; or, they are ſuch as act mechanically on theſe animals, irritating and tearing their tender bodies, and thus forcing them to relinquiſh their ſituation.

a. Castor Oil.
Doſe, about half a pound.

b. Gamboge.
Doſe, two or three drachms in a ball.

c. Mercury. *Calomel.*
Doſe for a horſe, two or three drachms; for a dog, about half a drachm, in a ball with purgatives.

d. Salt.

Doſe,

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Doſe, from four to ſix ounces, in a drench, or double the quantity by way of clyſter.

Said to have proved frequently ſucceſsful in expelling worms, when followed by a briſk purgative.

e. SAL INDUS.

A ſalt lately procured from the Eaſt Indies, ſaid to be ſucceſsful in expelling bots from horſes; but Mr White thinks that other worms have been miſtaken for bots, in the caſes where it has been ſucceſsful.

Doſe, about four or five ounces in a drench.

f. TIN. *Powder of Tin.*

Doſe, about an ounce, mixed with honey.

This promiſes to be one of the moſt effectual medicines in caſes of tape-worm, that are ſo common to dogs.

292 Receipts.

Receipts.

58. Take of calomel, jalap, each half a drachm;
Honey enough to make a ball.
For dogs.

59. Take of tin powder,
Quickſilver, of each two drachms.
Grind together till they be thoroughly mixed; then add enough of ſugar to form a powder, to be made up into a ball with caſtile ſoap, ſoftened with water.

60. Take of ſal indus, four ounces;
Alum, half an ounce;
Water, a pint.
Diſſolve for a drench. For the botts in horſes.

293 Chemical remedies.

16. CHEMICAL REMEDIES.

Many remedies are given internally, or applied externally, which ſeem to act merely chemically, either by combining with an acid or alkali, and thus neutralizing it, by checking putrefaction, or correcting the ill ſmell that is produced by it; or, in external applications, by deſtroying or corroding the parts to which they are applied. This claſs will therefore comprehend,

1. All thoſe medicines that have been called *antacids* or *abſorbents*, which are given to correct acidity in the ſtomach and bowels.

2. *Antalkalines*, or thoſe acid ſubſtances that are given more rarely to correct alkaleſcence.

3. *Antiſeptics*, or thoſe that are ſuppoſed capable of obviating putrefaction.

4. *Cauſtics* or *eſcharotics*, which are intended to corrode the ſkin, or to take down fungous or proud fleſh in ulcers.

a. ALUM.

Burnt Alum.

Sometimes applied to ulcers, to wear down proud fleſh.

b. AMMONIA.

Spirit of Sal Ammoniac. Water of Ammonia.

Doſe, a drachm or two, in a drench, for acidity in the ſtomach and bowels.

c. ANTIMONY.

Butter of Antimony. Muriate of Antimony.

Sometimes applied to foul ulcers. A violent cauſtic.

d. CHARCOAL.

Given internally in powder, to correct the bad ſmell in violent purging; and when powdered fine, may be ſprinkled on large ſtinking ſores, with the ſame intention.

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c. LIME.

Lime-water. Doſe about a quart, in acidity of the ſtomach.

f. CHALK.

Carbonate of Lime.

Doſe, an ounce or two.

In violent purging attended with acidity.

g. SILVER.

Lunar Cauſtic. Nitrate of Silver.

Employed to eat down proud fleſh, or deſtroy horny excreſcences.

h. SPIRIT OF SALT. Doſe about two drachms, mixed with a quart of water by way of drench.

i. VINEGAR.

Given internally as an antiſeptic, diluted with an equal quantity of water, or uſed externally to waſh foul ulcers.

k. VITRIOLIC ACID.

Doſe, a drachm or two, as under ſpirit of ſalt.

l. YEAST or BARM.

Employed to make fermenting poultices in caſes of ſtinking ulcers.

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Receipts.

61. Take of prepared chalk, an ounce;
Powdered ginger, two drachms;
Honey enough to make a ball.
In purging attended with griping.

62. Take of purified ſoda in powder,
Powdered gentian root, each two drachms;
Powdered caſſia, a drachm;
Treacle enough to form a ball.
In indigeſtion, with acidity of the ſtomach and bowels.

63. Take of charcoal in powder,
Powdered oak bark, each an ounce;
Treacle enough to make a ball.
In violent purging, producing very fetid ſtools.

64. Take of oat meal,
Powdered charcoal, of each four ounces;
Thin yeaſt, a ſufficient quantity to make a poultice.
To be applied to foul ulcers.

65. Take of aquafortis, an ounce;
Filings of copper, half an ounce.
Diſſolve in a gentle heat, taking care to avoid the fumes.
For a cauſtic, in canker of the foot. It may be made into an ointment for the ſame purpoſe, by mixing with hog's lard.

66. Take of freſh burnt quicklime powdered,
Soft ſoap, of each equal parts.
Mix at the time of uſing.
A mild cauſtic, uſeful in deſtroying parts of the ſkin where neceſſary.

67. Take

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67. Take of corroſive ſublimate, half a drachm;
Ardent ſpirits, two ounces.
Diſſolve for a lotion.
Uſeful as an application to the callous edges of ulcers.

295 Miſcellaneous remedies.

17. Miscellaneous Remedies.

a. Eggs. The Yolk.
Sometimes employed among the common farriers as a remedy for broken wind, but appear to be uſeful only for the purpoſe of combining oily ſubſtances with water.

b. Elecampane. *Enula helenium.* Lin.
The root in powder. In the form of ointment for the itch or mange.

c. Glass.
Powdered glaſs is ſometimes blown into the eyes of horſes, to remove ſpecks on the cornea.

d. Lead.
White Lead. White Oxide of Lead.
Sometimes uſed by way of ointment in ſome diſeaſes of the ſkin.

e. Diachylon Plaister. *Litharge Plaiſter.*
Employed in making charges or ſtrengthening plaiſters.

f. Bays. *Laurus nobilis.* Lin.
Oil of Bay.
Sometimes uſed in ointments for the mange.

g. Stavesacre. *Delphinium ſtaphiſagria*, Lin.
The ſeeds in powder. Employed to deſtroy vermin, being ſprinkled on the ſkin.

h. Zinc.
White flowers of Zinc. White oxide of Zinc.
In ointment, to ſores and ulcers.
Calamine. Impure Carbonate of Zinc.
Employed to make the common brown cerate.

206 Receipts.

Receipts.

68. Take of ſulphur vivum finely powdered.
Powdered elecampane root, each two ounces;
Hogs lard, enough to form an ointment.
For the mange.

69. Take of ſulphur vivum powdered, four ounces;
Salt butter, ſix ounces;
Train oil,
Oil of turpentine, each one ounce.
Mix well together into an ointment.
Theſe two ointments are uſeful applications in the mange.

70. Take of hogs lard, four ounces;
Tar, two ounces.
Melt together into an ointment.
Employed to anoint the backs of ſheep or cattle, when bitten by the gad-fly.

71. Take of burgundy pitch, four ounces;
Barbadoes tar, ſix ounces;
Bees wax, two ounces;
Red lead, four ounces.
Melt the pitch, tar, and wax together, and when the mixture is nearly cold, ſtir in the red lead, and continue ſtirring till it is firm.
This is Mr White's receipt for making charges, or ſtrengthening plaſters.
In caſes of wind-galls and old ſtrains.

Before concluding this part, it will be proper to make a few obſervations, on the cuſtom that prevails ſo much among grooms and farriers, of adminiſtering medicine to horſes, by way of preſervatives of health, or preventives of diſeaſe. It is very common among theſe gentlemen to bleed or phyſic a horſe at leaſt twice a-year, viz. in the ſpring and fall, though he be in never ſuch good health, or good condition; to give him ſulphur and antimony now and then *to keep his coat fine;* and to adminiſter a cordial ball, or a doſe of *diapente* occaſionally to *improve his appetite.* If he is to undergo any unuſual exertion, as riding or hunting, it is judged neceſſary by theſe ſagacious practitioners to prepare him for the work, by bleeding, purging, and ſweating below a load of body clothes in a cloſe, hot ſtable. In purſuing this cuſtom, they indeed only imitate what they practiſe on themſelves on ſimilar occaſions. As they deem it neceſſary to have themſelves bled every ſpring and fall, or once a quarter, to take phyſic once a month, and to ſweat themſelves to make them ride or run more lightly in a jockey match, they naturally conclude that their horſes ſhould be treated in the ſame manner, and ſhould undergo the ſame preparation.

Materia Medica.

297 Impropriety of giving medicines to horſes unneceſſarily.

If an animal is in a perfect ſtate of health, nothing more is required to render him capable of performing the functions for which he is intended. It is only when there appears ſome derangement of the ſyſtem, or when the ſtate of the body is ſuch as to threaten the attack of ſome dangerous diſeaſe, that it is neceſſary to call in the aſſiſtance of medicine. We ſhall ſoon have occaſion to mention caſes of this kind, and to ſhew how the threatened danger is to be avoided. It muſt be remembered that thoſe ſubſtances that are called medicine, are ſuch as produce ſome effect on the body, that is in general either unnatural, or is greater than what commonly takes place in a ſtate of perfect health. If then we give medicines to an animal in this healthy ſtate, we either excite the organs to ſome unuſual exertion, or we check thoſe exertions that are natural and healthy; and in either caſe, we muſt do harm. Beſides the cuſtom of giving medicines when they are unneceſſary, renders them leſs efficacious when they are abſolutely required, to ward off or obviate any diſeaſe. It is found that moſt remedies, when employed habitually, require to be increaſed in quantity in order to produce the ſame effect, and if continued too long they ſometimes ceaſe to produce their effect at all. With reſpect to ſome remedies, it is found that their habitual uſe is attended with dangerous conſequences. Frequent bleeding tends to produce fatneſs, and a plethoric ſtate of the body; the frequent uſe of cordials and aſtringents ſtimulates the circulation too much, and produces ſuch a rigidity of the fibres, as lays the foundation of apoplexy, palſy, and other dangerous diſorders. It is well known, too, that when the action of the ſtomach is too much excited by the habitual uſe of ſtimulants, it in time loſes its tone, and becomes incapable of healthy digeſtion, unleſs rouſed by a greater quantity of its accuſtomed ſtimulus. It is therefore obvious that when an animal is in perfect health, all that is required to keep him ſo, is the proper regulation of diet, exerciſe, cleanlineſs, and other circumſtances that have been mentioned in the fourth part of this article.

We cannot better illuſtrate the abſurdity of the uſual methods

Diſeaſes. methods of preparing horſes for a race, than by the following caſe, which fell under the obſervation of Mr Clark of Edinburgh. "Two military gentlemen betted their horſes to run againſt each other on the ſands of Leith for a conſiderable ſum, and this was to take place three weeks after the bet. The horſes were to be ridden by their own grooms. Captain R's was a poney about 13½ hands, Captain M's was a gelding about 15 hands high. Both grooms were bred at Newmarket, and were keen advocates for bleeding and purging, though both the horſes had been kept on dry food, and in the beſt order, and the interval of time for ſuch treatment was very ſhort. This bleeding and purging was in order to prepare them the better for running. Captain M's horſe was bled once, and purged twice. Captain R's was bled once, and purged once. Both were ſweated in the ſtable with a great load of clothes; and their ſtables, though ſeparate, were kept uncommonly hot, and cloſely ſhut up day and night, though it was in the midſt of ſummer. From this treatment the horſes ſoon loſt their appetite, and in the courſe of eight or ten days their ſtrength was ſo much exhauſted that they were ſcarcely able to go through their uſual exerciſe on the ſands. In this ſituation Captain R. conſidered his bet as loſt, and expected nothing leſs than the loſs of his poney, on which he ſet a high value. Luckily, however, the groom, who was rather corpulent, had put himſelf under a courſe of phyſic, to bring himſelf down to the proper weight, and was unable to proceed in his plan of purging and ſweating the horſe. The poney was therefore provided with another groom, and was put under the care of Mr Clark, who, ſeeing the abſurdity of the plan which had hitherto been obſerved, ordered his clothing to be reduced to a ſingle rug, and the ſtable windows to be thrown open, to admit the freſh air. The poney ſoon recovered his appetite; and his activity, ſtrength and ſpirits were in a great meaſure reſtored. Captain M's horſe in the meantime was continued under the debilitating regimen. When the race came to be decided, though at ſtarting the odds were conſiderably in favour of Captain M's horſe, yet his opponent won the race with conſiderable eaſe. Diſeaſes.

PART VI. OF THE DISEASES INCIDENT TO DOMESTIC ANIMALS.

299 IN treating of the diſeaſes of domeſtic animals; we ſhall claſs them in two great diviſions: in the firſt of which we ſhall conſider moſt of thoſe morbid affections which are uſually called *local* and *ſymptomatic*, or in general thoſe ſimple affections of the ſeveral functions, that are moſt eaſily underſtood, and require the leaſt complicated mode of treatment. In the ſecond of theſe diviſions we ſhall treat of the more complicated diſeaſes, or thoſe in which the whole ſyſtem is more or leſs affected, and of which the treatment is more difficult, and in general more precarious.

300 Claſſification of ſymptoms. When an animal is diſeaſed, he is affected with ſome or other of the following ſymptoms.

1. *Of Senſation.*

301 Of ſenſation.
He labours under too acute ſenſibility; or,
He is affected with pain or itching.
His ſenſibility is unuſually diminiſhed.
His ſenſe of ſmelling is more or leſs impaired.
He hears with difficulty, or not at all.
His viſion is more or leſs impaired.
He is unuſually watchful.
His ſleep is diſturbed; or,
He is unuſually heavy and drowſy,

2. *Of Motion.*

302 Of motion.
He is either affected with irregular, involuntary motions or ſpaſms; or,
His moving powers are impaired.

3. *Of Digeſtion.*

303 Digeſtion.
His digeſtive organs perform their functions too quickly.
His digeſtion is impaired; or,
He does not digeſt at all.
He is affected with ſickneſs,
with flatulence, or wind in the ſtomach and bowels.

4. *Of Abſorption.*

304 Of abſorption.
He is unuſually *fat*; or,
unuſually *lean*.
He is affected with ſome watery ſwelling.

5. *Of Circulation.*

305 Of circulation.
His circulation is too rapid; or,
It is too ſlow; or,
It is irregular.
He has ſome effuſion of blood.

6. *Of Reſpiration.*

306 Of reſpiration.
His breathing is hurried; or,
It is difficult.
He is affected with cough;
with ſneezing,
hickup.
His breath is hot; or,
It is cold.
His ſkin is unuſually hot; or,
It is unuſually cold.

7. *Of Secretion and Excretion.*

307 Of ſecretion and excretion.
His ſecretions and execretions are either unuſually copious.
He ſtales profuſely.
He has a purging; or,
His ſkin is unuſually moiſt.
The ſecretions and excretions are morbidly diminiſhed.
He ſtales with difficulty, or not at all.
He is coſtive.
His ſkin is unuſually dry.

8. *Of*

Diſeaſes.

8. *Of Generation.*

308 Of generation. His venereal appetite is exceſſive; or,
It is morbidly impaired.
He is impotent.

When a practitioner comes to examine one of theſe animals whoſe health is deranged, he will naturally inquire into all or moſt of the above particulars, and they will in general apply to all the four animals of which we are treating. There are ſome other queſtions which peculiarly relate to horſes, and which it more eſpecially becomes a farrier to aſk; as, Whether his flanks work. Whether his ears are cold; or are in conſtant motion.

309 Enquiries proper to be made by a farrier.
In what manner he walks.
Whether he looks earneſtly at his ſides.
Whether his eyes appear drowſy.
In what manner he carries his head.
Whether he kicks his belly.
Whether he appears deſirous to lie down, but afraid to do ſo.
Whether he ſometimes lies down on one ſide, and then immediately turns to the other.
Whether he lies down and ſlies up again repeatedly.
Whether he leans upon the manger.
Whether he ſtands off from the manger.
Whether he paws his litter.
Whether his noſe runs.
Whether or not he paſſes much wind.

It will alſo frequently be of conſequence to aſcertain the following particulars.

Whether the horſe is uſually in a poor condition.
How did the diſorder begin?
How long it has continued.
How long it is ſince he ate or drank.
Has he ever had the diſorder before?
If he has, What was uſually given him on theſe occaſions?
Does the diſorder come on at any particular times?
Has he been obſerved to paſs any worms?
How long he has been bought, and what price was paid for him.
Was he bought of a horſe-dealer, or of a private perſon?
Of a friend, or at the public market?

310 Having aſcertained the neceſſary particulars, it is proper to conſider whether the diſeaſe is of ſuch a nature as has in general been eaſily removed; or whether the expence and time of cure will be ſufficiently compenſated by the value of the horſe; for it muſt be remarked, that in general a horſe or other domeſtic animal is worth no more than the price he would fetch at the public market. Unleſs, therefore, the animal is a favourite, or has ſome particular good quality which greatly enhances his value, it may happen that the expence and trouble of cure may amount to more than the animal is worth. In ſuch a caſe it would be both prudence and mercy to kill him, unleſs we wiſh to attempt his cure for the ſake of experience. Theſe obſervations of courſe equally apply to caſes that are generally deemed incurable.

Having found that the diſeaſe is of ſuch a nature as to give hopes of a ſpeedy or perfect cure, it will next be proper for the practitioner to conſider what is the ſpeedieſt, ſafeſt, and cheapeſt method of treatment. In particular, he ought to conſider whether any immediate remedy be neceſſary, in order to check the violence of the diſtemper; more eſpecially whether any immediate evacuation is required, as bleeding, purging, bliſters, rowels, &c. Diſeaſes.

He muſt alſo be particular in examining whether the diſeaſe be of a contagious or infectious nature, that the affected animals may be kept in a ſeparate place from thoſe which have not been attacked.

311 As the general nature and theory of diſeaſe will be conſidered at large under the medical department of this work, we have only in this article to detail the ſymptoms as they occur in the domeſtic animals; to point out the cauſes and ſeat of the diſeaſe, as far as they have been aſcertained by obſervation and diſſection; and to lay down the moſt approved methods of treatment adapted to theſe animals. Obſervations with reſpect to the theory of diſeaſes would here be out of place, and we ſhall ſeldom hazard them, except in ſome of thoſe ſpecific complaints which appear to attack ſolely the animals of which we are treating.

312 Claſſification of the diſeaſes. It may not be improper to remark, that diſeaſes, like the objects of natural hiſtory, have been arranged in two methods. One of theſe is the natural method, in which they are claſſed according to their ſeat or cauſes. The cauſes of diſeaſes are the foundation of Dr Darwin's ſyſtem. In the firſt ſection of this part we ſhall attempt to claſs the morbid ſymptoms according to their ſeat, or the functions which they attack. The other method of arrangement, or the artificial method, is that in which diſeaſes are arranged according to ſome obvious and remarkable ſymptoms. This is beſt calculated for the purpoſe of recognizing the diſeaſe when ſeen, and is the method employed by moſt noſologiſts. The diſeaſes in the ſecond ſection of this part will be arranged in this way.

SECT. I.

Chap. I. *Of Morbid Affections of Senſation.*

313 Morbid ſenſibility. Most animals are occaſionally ſubject to a morbid increaſe of ſenſibility, either of the whole nervous ſyſtem, or of ſome particular organ. This morbid ſenſibility is generally called by medical writers, *irritability;* but this name is improper, as it implies an affection of the muſcular parts; whereas the ſymptom we are now conſidering is an affection of the nervous ſyſtem.

Some horſes naturally poſſeſs a morbid degree of ſenſibility, which appears by their ſtarting on the ſudden approach of any object, by the peculiar tenderneſs of their ſkin that makes them wince and tremble under the currycomb, and by the extreme ſenſibility that they evince at the leaſt touch of the whip or ſpur. Such horſes are in general very active and ſpirited; but they require a cautious and prudent rider, who muſt rather endeavour to ſoothe and encourage them, than uſe any harſh or violent means.

This increaſed ſenſibility is not eaſily removed by art, but

Diſeaſes. but generally decreaſes as the horſe grows older. It is beſt counteracted by living in a large well-aired ſtable, by being kept on hard coarſe food, and by lying with as little litter below him, as is ſufficient to prevent him from injuring himſelf againſt the pavement of the ſtable. In dreſſing him the currycomb ſhould not be too ſharp, and ſhould not be employed too freely.

When exceſſive ſenſibility ariſes from a delicacy and weakneſs of habit, ſtrengthening medicines will be of uſe, and cordials may occaſionally be employed.

There is a ſymptom nearly allied to this, which ſometimes appears. The animal affected gathers himſelf together, and brings his four legs as cloſe as poſſible below him, and creeps as it were all on a heap. This ſymptom often attends nervous diſeaſes, and ſevere affections of the bowels. It is generally conſidered as a ſign of great danger, and is not unfrequently the forerunner of mortification.

At the commencement of ſeveral acute diſeaſes, eſpecially thoſe of the brain, animals betray an unuſual ſenſibility to the effects of light and ſound. When this happens, the place where they are kept ſhould be darkened, and they ſhould be as little as poſſible diſturbed with noiſe.

314 Reſtleſſneſs, or anxiety. There is a peculiar *reſtleſſneſs and anxiety* with which animals are ſometimes affected. This is not unfrequently their only complaint, or at leaſt we cannot perceive that they are affected with any obvious or well-marked diſeaſe, but it is moſt commonly a ſymptom attending violent diſorders, eſpecially of the inflammatory kind; and generally preceding the fatal termination of dangerous chronic diſeaſes. Animals thus affected are continually moving about, and often lie down; if they are at liberty, they ſeek out the moſt ſequeſtered and gloomy parts of the paſture, and frequently change their place: if they are tied up, they appear to liſten to, or obſerve, every thing that paſſes round them; they are reſtleſsly attentive to the various objects near them; but although their eyes appear fixed, and wide open, they do not ſtedfaſtly regard any object; they are perpetually turning from ſide to ſide, and if they feel pain in any part, they often turn their heads mournfully towards it, ſometimes groaning or panting. If this ſtate has continued long, the animals become ſtill more reſtleſs, are perpetually ſhifting about, ſcraping with their feet and pawing the litter; their ears become cold, and their hairs briſtle up.

Theſe latter ſymptoms are conſidered as denoting great danger, eſpecially when the animal looks ſtedfaſtly at his ſides, or ſtares with his eyes without appearing to take particular notice of any object.

When anxiety appears to be the only ſymptom, without any ſigns of inflammation or convulſive affection, it is generally a mark of nervous weakneſs, and requires cordial and ſtrengthening remedies, nouriſhing diet, and gentle exerciſe without labour: but if it is a ſymptom of ſome violent diſeaſe, it can only be removed by the general treatment of that diſeaſe; and in this view, will come to be conſidered hereafter.

315 Depreſſion of ſpirit. Animals are ſometimes affected with dejection or loſs of ſpirit. This is not unfrequently the attendant

316 Fatigue. of fatigue brought on by exceſſive labour or unuſual exertion; and is therefore moſt commonly ſeen in horſes. It appears by the animal's leaning his head on the manger, ſtanding ſtill in the ſame place, and appearing to move with pain or difficulty. His limbs are ſtiff, his ſkin hard and dry, his eyes look ſad, he has no appetite for meat; if he lies down, he remains immoveable, or if obliged to riſe, immediately falls again when left to himſelf. Diſeaſes.

In general, if the fatigue produced be not extremely great, it gradually goes off with reſt and quiet, eſpecially if it has been found practicable to employ the means that are preſently to be recommended; but if the exertion to which the animal was expoſed, has been too great for its ſtrength, the conſequent depreſſion may prove highly dangerous, or even fatal. In this ſtate his urine is crude and watery, and, if a male horſe, he ſeems ſcarcely to have the power of *drawing* for the purpoſe of making water; and his excrements are dry and ſcanty. If taken out in this condition he moves with pain and difficulty, trots ſlow, or lifts his feet very little above the ground, carries his head very low and his ears depreſſed over his forehead; he often ſtumbles, and not unfrequently falls on his knees, and appears very little ſenſible of the whip or ſpur. If a horſe in this ſtate has any ſores or ulcers about him, they become hard, or flabby, aſſume a dull appearance, and the matter proceeding from them becomes thick and viſcid. Bowels very frequently dry up; and if he is affected with any eruption of the ſkin, this commonly diſappears.

To prevent the bad conſequences that are likely to follow the ſtate which we have now deſcribed, it is proper, as ſoon as we find a horſe much fatigued, to ſpread a bed of litter for him to reſt on; and as ſoon as poſſible give him a cordial ball, or drench. The ſtrength of this muſt not, however, be in proportion to the degree of fatigue or depreſſion; as experience has ſhown, that when a powerful cordial is given in a ſtate of exceſſive weakneſs, it proves too much for the animal, and frequently excites fevers or inflammation. The horſe's limbs ſhould be bathed with warm water, and then rubbed thoroughly dry. After this he ſhould be left to his repoſe, and if it be not too late at night, he may in a few hours have a warm bran maſh. When a little recovered, he muſt be gently rubbed all over, but eſpecially his limbs, without currying; he ſhould be put upon a nouriſhing diet, and exerciſed but little. Theſe means, varied according to circumſtances, will in general bring the horſe round, unleſs the ſymptoms are extremely violent; when they will commonly terminate in fever, or in ſome chronic diſeaſe, eſpecially dropſy.

The train of ſymptoms which we have been deſcribing, are moſt commonly the effect of fatigue; but they may ariſe from other cauſes. They are more or leſs the attendants of decay, and they are generally the forerunners of fever or inflammation of the brain.

317 Inſenſibility, drowſineſs. Sometimes theſe animals are affected with a great degree of inſenſibility or torpor; they are heavy and liſtleſs; lie much; are not eaſily diſturbed; are inattentive to the objects around them; ſeem to be inſenſible to pain, and move heavily and unwillingly. Theſe ſymptoms require particular attention, as in moſt caſes they denote ſome dangerous affection of the brain, and are very commonly followed by apoplexy or *ſtaggers*; or by epilepſy; or they are the attendants (eſpecially in ſheep) of water in the head. Wherever they are obſerved to take place in an animal that has been full fed, with little exerciſe, eſpecially if he appear fat and full

of

Diſeaſes. of blood, and the pulſe be found full and ſtrong, the eyes red or heavy, there is danger of apoplexy; and the animal ſhould immediately be bled and purged, be gradually put on a lower diet, and uſe gradually more exerciſe. Theſe changes muſt be made by degrees, becauſe too ſudden changes may produce the very effects againſt which we are guarding.

A great degree of torpor and inſenſibility is often produced by exceſſive cold, or by being kept long in an impure atmoſphere. Where they have taken place from either of theſe cauſes to a dangerous degree, the application of heat muſt not be too ſudden, as it will tend to extinguiſh the ſmall remaining ſpark of life, and produce apoplexy, or mortification, where any external part has ſuffered from cold.

318 Giddineſs, or turn-ſick. The head may be affected with dizzineſs, or giddineſs, commonly called *turn-ſick*, from various cauſes. It may ariſe from great weakneſs, or it may be the conſequence of plethora, or fullneſs of blood. In the latter caſe, it is a pretty ſure mark of approaching apoplexy or ſtaggers; and the animal muſt immediately be bled, and put on a lower diet, with gentle exerciſe. In ſheep, dizzineſs is a common ſymptom of ſturdy, or water in the head, a complaint which will be conſidered hereafter. It will be evident that when this affection appears in animals that are lean, meagre, and in low condition, it ſhows the neceſſity of a more full and nouriſhing diet.

319 Blindneſs. The only morbid affection of the external ſenſes, that we ſhall here conſider is blindneſs, a defect which is of moſt conſequence in the horſe, though it may occur in all the domeſtic animals.

320 Marks of a ſound eye. The eyes of a horſe, when perfectly ſound, have the cornea or outer covering, and the humours that are ſeen through it, perfectly clear and tranſparent; there ſhould be no ſpecks, or *dragons* as they are called, in either; no greenneſs or glaſſy appearance of the pupil, and this ſhould readily contract when ſuddenly expoſed to a clear light. Buffon obſerves, that in a ſound eye, two or three foot-coloured ſpots appear through the cornea above the pupil.

321 Partial blindneſs. When a horſe has a defect in his viſion, without being perfectly blind, he appears dull, fearful, and reſtive, ſtarts at ſuddenly approaching any object, carries his head high, or to one ſide; moves his ears alternately, or turns one forwards, while the other is turned backwards; and uſually hangs back on his bridle or halter, and lifts his legs up very high.

Partial blindneſs is a ſymptom of ſeveral diſeaſes in the horſe: it uſually attends great weakneſs, eſpecially when this has been brought on by hard work and low feeding; it is a common attendant on locked jaw, and generally precedes the ſtaggers. It of courſe is one of the effects of old age.

When proceeding from debility, it generally goes off in proportion as the ſtrength is reſtored by reſt and proper nouriſhment; when it is a ſymptom of other diſeaſes, it goes off when they are removed. The blindneſs of old age is incurable, and in the horſe we believe no method has yet been diſcovered of relieving the defect by art.

It is generally allowed, that it is better to have a horſe totally, than partially blind; as when quite blind, he is not liable to ſtart, or be ſhy; and when ſure footed, well ſhod, and managed by a careful rider, there is little danger of his ſtumbling or falling. Diſeaſes

322 Total blindneſs. Total blindneſs either proceeds from a defect in the optic nerve, by which this is rendered incapable of receiving the impreſſion of light, or from an opacity or muddineſs in the cornea or humours, by which the tranſmiſſion of light through them is obſtructed.

323 Glaſs eyes. The firſt ſpecies of blindneſs, or that depending on a defect in the optic nerve, is generally called by farriers *glaſs eyes*, and by medical writers, it is termed *amaurosis*, or *gutta ſerena*.

It is known by the peculiar glaſſy appearance of the eye, which ſeems perfectly clear, ſo that an ordinary obſerver would not ſuppoſe that there was any defect in the horſe's eye. On examining the eye however more attentively, it will be found that the pupil is conſiderably dilated, and preſerves the ſame ſize in every change of light; not contracting, as uſual, when the light to which it is expoſed becomes ſtronger. There is alſo a greeniſh appearance of the eye in this diſeaſe.

The cauſes of glaſs eyes are not well aſcertained. It has followed a blow on the head, or inflammatory affections of the brain or its membranes, but it has come on ſometimes imperceptibly, and where theſe diſeaſes, or any other evident cauſe has not appeared.

This diſeaſe in the horſe has hitherto proved incurable.

324 Cataract. The moſt common cauſe of blindneſs in the horſe, is an opacity of the lens, or cryſtalline humour of the eye. This diſeaſe is known by the name of *cataract*, and is ſometimes called by farriers, *moon blindneſs*, or a horſe that has a cataract is ſaid to be moon-eyed.

It is in general eaſily diſcovered that a horſe labours under a cataract, as, when the diſeaſe is confirmed, an obſcurity or muddineſs may be ſeen in the centre of the pupil, occupying more or leſs of the opening, according as the cataract is more or leſs extended. The opaque ſpot is generally of a dull white or yelloviſh colour. Sometimes the cryſtalline humour is ſo fixed to the iris, or that moveable coloured part in the middle of the eye, as to obſtruct its motion, and then the pupil retains the ſame ſize in every light; or if the adviſion is partial, the pupil of the eye aſſumes an irregular ſhape. It muſt be obſerved, that in this diſeaſe, the iris is not always ſo immoveable as in glaſs eyes; though when the cataract is fully formed, the pupil is generally enlarged, and contracts very little on the approach of a ſtrong light. Sometimes the lens comes through the pupil altogether, and floats in the watery humour, in the fore part of the eye.

The cataract in horſes is ſaid to be always a conſequence of inflammation in the eye, which will be conſidered in the ſecond ſection of this part.

The only method that appears likely to remove the cataract, is an operation by which the opaque lens may be thruſt down below the pupil, or entirely extracted from the eye; but neither couching nor extraction can be recommended in the horſe, as the removal of the lens would ſtill be attended with a defect of viſion that would render the animal of leſs uſe, than if he were totally blind.

325 Opacity of the cornea. Another cauſe of blindneſs, and alſo a conſequence of inflammation, is opacity of the cornea. There may be either a diffuſe whiteneſs or muddineſs in the cornea, that is more or leſs extenſive; or, there may be ſpecks

Diſeaſes. or warts growing on the outſide of this coat, ſo as to obſtruct the paſſage of the rays of light. Sometimes the opacity of the cornea is only ſlight, producing partial blindneſs; but frequently it is univerſal, and then the horſe cannot ſee at all. This univerſal opacity of the cornea is ſometimes, though improperly, called *cataract*. It ſometimes diſappears for a time, and the eye ſeems nearly as clear as ever; but it generally returns in no long time.

General opacity diffuſed through the ſubſtance of the cornea, does not readily yield to remedies. Attempts have been made, by ſcarifying the veſſels on the white of the eye, or by ſtimulating applications to the cornea, to rouſe into action the abſorbent veſſels of the eye, and thus remove the opacity; but theſe attempts ſeem to have been attended with little ſucceſs. Specks or warts on the cornea, if they are not too large, may generally be removed by the knife, or by repeatedly blowing into the eye a powder compoſed of powdered glaſs and white vitriol. But, if theſe ſpecks are attended with any general opacity of the cornea, little benefit is to be expected from theſe operations.

326 Warts. As the ſkin is ſo intimately connected with ſenſation, we ſhall here conſider ſome of the more ſimple affections of that organ, that are not generally attended with fever. It is not uncommon for excreſcences or warts to grow on the ſkins of domeſtic animals, particularly on horſes and oxen. Sometimes they are hard and firm; at others they are ſoft and ſprouting: in ſome their root is ſmaller than their head; in others the baſe is the largeſt part. The ſprouting kind of warts are called by the farriers *anger-berries*, *ambury* or *ambery*, and are not uncommon among oxen. As theſe are largeſt at the baſe, they can, like all of that deſcription, be removed only by touching them daily with ſome cauſtic, as lunar cauſtic, or butter of antimony. Where the wart has a ſmall root, it may be beſt removed by tying a ſtrong waxed thread round the root, tightening it now and then as it gets looſe till the wart drops off. It is in general not proper to remove warts by the knife, unleſs they are of ſuch a firm conſiſtence as not to bleed on being cut, and to admit of the application of cauſtic after cutting.

327 Mallenders and ſallenders. There ſometimes appears on the ſkin of the horſe, a ſcurfy eruption at the bending of the knee, or the bending of the hock. The eruption generally appears in both places at once, and is called by farriers, the *Mallenders* and *Sallenders*; a term which they have borrowed from the French. When conſidered ſeparately, the eruption of the knee is called the *mallenders*, and that of the hock the *ſallenders*.

Theſe eruptions may generally be traced to want of cleanlineſs, and are, in moſt caſes, eaſily removed, by waſhing the parts with ſoap and water, and applying an ointment, compoſed of mercurial ointment and camphor; or either of the ointments marked N° 41. and N° 70. in the receipts.

328 Hide-bound. When a horſe's ſkin is hard, dry, and unuſually tight about the body, the animal is ſaid to be hide-bound. This tightneſs about the ſkin is uſually the effect of hard work and improper food; and commonly attends lingering diſeaſes, in which the fat is gradually waſted or abſorbed. It muſt therefore be conſidered rather as a ſymptom of diſeaſe than as a diſeaſe itſelf: but, as is the caſe with moſt remarkable ſymptoms, it has often been regarded as a primary diſeaſe; to remove which, by ſweating and relaxing remedies, is the principal object of the practitioner. Diſeaſes.

The proper remedies for this affection, when it is not a ſymptom of ſome lingering diſorder, are nouriſhing diet, with plenty of green food, particular attention to cleanlineſs, by frequent dreſſing, and the occaſional uſe of boiled barley and warm maſhes.

329 Surfeit. Horſes that have a lean, unthrifty-like appearance, with their coats looking rough and ruſty, are ſaid by the grooms to labour under a *ſurfeit*. Whence has ariſen the application of this ſtrange term to an appearance that ſeems ſo oppoſite to what is generally underſtood by a ſurfeit, we are not aware; but an affection of the ſkin, under the name of ſurfeit, is thus deſcribed by Mr Lawrence: "Its confirmed ſtate is attended with eruptions, and ſometimes with ſwellings of the legs and joints, and in the latter caſe is uſually to be looked upon, as the termination of ſome chronic diſeaſe, or a conſequence of the improper uſe of mercurial phyſic. Surfeits are ſtyled *dry* or *wet*; in the former, the ſkin is covered with a thick dry ſcurf, with ſcabs, and ſmall hard tumours like warbles; in the latter, a ſharp briny ichor iſſues from the poll, neck, withers, quarters, and hinder legs, in the bend of the hock, cauſing great ſtiffneſs and inflammation; this is probably analogous with ſcurvy in the human body, and will often attend cart-horſes, with foul and unwholeſome blood, at ſtated periods. The too free uſe of beans will produce the wet ſurfeit.

"The cure of *furfeits* depends almoſt entirely upon internal alteratives, with a very ſmall attention to external applications. As to the latter, perhaps, frequent cleanſing, with a good ſtrong lather of ſoap is generally ſufficient, but where the eruptions are hard and fixed, and the ſcabs do not peel off, I know of nothing better than to rub them frequently with the ſtrong mercurial unction, keeping the horſe well clothed, and giving warm water in the interim. The warm bath if the animal is ſtrong *." * *Lawrence on Horſes*, vol. ii.

330 Mange in horſes. One of the moſt common diſeaſes of the ſkin among domeſtic animals, is what is commonly called the *mange* in horſes, cattle and dogs, and the *ſcab* or *itch* in ſheep. Its ſymptoms differ but little in the different ſpecies of animals, and we do not remember to have ſeen the diſorder well deſcribed by any writer. The following deſcription of the mange in horſes by Mr Feron, is perhaps among the beſt that have been publiſhed. "The mange is a contagious chronical diſorder which manifeſts itſelf in the ſkin, on which ſenſible eminences of a roundiſh figure riſe up; theſe being ſcratched, a fluid oozes out, of a hot and corroding quality, that excoriates the ſound ſkin wherever it runs, in a little time forming a dry, ſcaly, cruſty eruption, which in its progreſs ſpreads over the whole ſurface of the body; and the ſkin becomes unequally thick, thin, hard, and ſoft. If the diſorder has been neglected, or ill-treated, the animal falls off from his food, grows lean, and the legs ſwell; in this ſtate the patient has frequent fits of ſhivering and trembling, and a ſlight fever ariſes, terminating in farcy or the glanders, by which he is eaſily deſtroyed †." † *Feron's Farriery.*

331 In cattle. A diſeaſe ſimilar to this, if not of the ſame kind, affects cattle, eſpecially ſuch as are ill fed, and not kept clean. It is commonly called by herdſmen, the *ſcab*

or

Diſeaſes. or *ſcurf*; and is thus deſcribed in a popular treatiſe on cow-doctoring.

Skin ſtiff, and ſits faſt to every part of the carcaſe, as if too ſmall for the body. It makes its firſt appearance about the head and jaws of the animal, with a ſcurfy, pale, and dry texture; and the beaſt begins to ſcratch againſt every thing that comes in its way: it then ſhews itſelf along the back, and behind the ſhoulders; and if timely aid be not procured, the animal will tear its ſkin till it bleeds violently, which ought to be prevented, if poſſible, as the ſcabs which are the conſequence of bleeding, much retard the efficacy of the ointment, and the loſs of time confirms the diſorder.

332 In ſheep. This diſeaſe is incident to ſheep in ſome particular paſtures, ſituations, and ſeaſons, more than to others. The prediſpoſing cauſe ſeems to be a relaxed habit of body, produced by poverty or leanneſs, though ſome ſheep are ſubject to it that are fat, and otherwiſe in good condition. The diſeaſe ſeldom ſeems to originate with ſuch ſheep, but to be conveyed to them by infection. *

* *Findlater's Survey.*

333 In dogs. Dogs are exceedingly ſubject to the mange, and readily catch it from each other. The appearance of the diſeaſe in dogs, is familiar to every one, as there are few more common and diſguſting ſights than a mangy dog. A dog in this ſtate is very unfit for any active exertion, as the affection of the ſkin renders him ſtiff and ſore even in his limbs. A friend of ours had a greyhound, that, when he was clean, was one of the ſwifteſt runners in the country, and had gained the prize in many a courſing match. This dog caught the mange, and while in this ſituation was ſeveral times, ſent in purſuit of a hare; but now, puſs generally eſcaped him.

This diſeaſe has ſometimes been attributed to animalculæ, ſuch as are found in the ſymptoms of the itch upon the human ſkin; and analogy ſeems to be in favour of this idea. It is, however, evidently connected with poor living, and want of cleanlineſs.

334 Treatment. In the treatment of the mange, we are to rely chiefly on the uſe of external applications, ſuch as ointments, compoſed of ſulphur, of ſome preparation of mercury, or hellebore roots. The receipts marked N° 68 and 69 are well adapted to the cure of this diſeaſe. Sometimes internal remedies, ſuch as ſulphur and gentle laxatives, are required; and the greateſt attention muſt be paid to cleanlineſs, diet, and exerciſe. It may be neceſſary in ſome caſes, eſpecially where the animals that have caught the diſeaſe, are very full of blood, to bleed and give cooling phyſic previous to the application of ointment; and in all caſes the ſkin ſhould be thoroughly waſhed with ſoap and water, both before and after anointing. The animals ſhould always be confined till they are quite free from the diſeaſe.

Mr Feron, who conſiders the mange in horſes as a general affection of the ſyſtem, and not merely a local diſeaſe of the ſkin, ſtrongly recommends the uſe of bliſters, which he has ſeen act as a ſpecific. "The local treatment, and the only one to be depended upon (ſays this gentleman), conſiſts in a judicious application of bliſters, uſed after the following manner; viz. if the whole body is affected, the one half muſt be bliſtered one day, and the other in three days after. This muſt be done at different times, in order to prevent the cantharides from operating too violently upon the kidneys and bladder; but if this happens, let the animal be bled, and clyſters frequently injected. But the beſt way to avoid this, is to leave off all kinds of internal medicines, during the action of the bliſters. When they begin to operate, the ſkin muſt be fomented with warm water three times a-day, in order to waſh out a quantity of yellow matter, diſcharged by the action of the bliſters, and to encourage the growth of new hair." We do not pretend to diſpute the efficacy of Mr Feron's bliſtering practice in removing the mange, but we doubt whether the bliſtering one half of the body with cantharides may not be productive of more ſerious conſequences than the diſeaſe which it is intended to remove. At any rate, the expence of the method, and the torment which it muſt occaſion to the poor animal, muſt greatly prevent the general application of the remedy. Diſeaſes.

In Mr Findlater's ſurvey, quoted above, are the following judicious obſervations on the treatment of ſheep labouring under the ſcab.

"Sheep that are regularly tarred, or ſmeared, are ſeldom infected with this diſeaſe. If the diſeaſe be partial, perhaps the beſt remedy would be to clip the affected parts as bare as poſſible, and rub them occaſionally with the common ſmearing ointment, to which may be added a little Venice turpentine. They ſhould alſo be waſhed, once or twice a week, with black ſoap and water. But if this prove ineffectual, or if the diſeaſe has gone to a great extremity, the animal ſhould firſt be waſhed as clean as poſſible, in a pond, or rill of water, to purge away all the accumulated virus, or infecting matter, from the wool. A little black ſoap may be of great uſe in waſhing. Then the whole body may be ſmeared with juice of tobacco; and after the animal becomes dry, may be rubbed with butter mixed with powdered brimſtone; or brimſtone mixed with the ſmearing ointment would anſwer better. A little of the ſulphur may meanwhile be thrown down its throat. If this treatment, being twice or thrice repeated, after an interval of ſeveral days, ſhould prove ineffectual, recourſe muſt be had to the mercurial ointment, compoſed of three ounces of hogs lard, well rubbed in a mortar, with half a drachm of finely powdered corroſive ſublimate; or the ſame proportion of corroſive ſublimate, well mixed with three ounces of the common ſmearing ointment, will anſwer equally well. The animal being ſmeared with this ointment, will ſoon be effectually cured. Meanwhile the diſeaſed animal ſhould be invigorated or put upon ſubſtantial food."

In a note Mr Findlater mentions an obſervation of Mr Loch's of Rachan, that the matter diſcharged in the ſcab mixing with the wool, and drying, forms a hard impenetrable cruſt, which he has obſerved of half an inch in thickneſs; that it is vain to think of curing it by any external application, till this is removed; and that you might as well attempt to cure a man of the itch, by rubbing butter and brimſtone upon his coat, inſtead of his naked ſkin; that the ſcurf thus formed, muſt be removed by ſoaking and waſhing it with warm lime-water and ſoap, and ſcraping it clean to the quick with a blunt knife. It may then be ſucceſsfully cured by the ointment; or, what is more cleanly and more eaſily prepared, by means of a lotion made by diſſolving half a drachm of corroſive ſublimate in a quart (chopin) bottle of whiſky and water. Mr Loch has always

Diſeaſes. always found this lotion effectual, after two or three applications.

It has been propoſed by a correſpondent of the Farmer's Magazine, to inoculate ſheep for the ſcab, in order to render it milder. Even ſhould inoculation have this effect, which is by no means certain, it does not appear neceſſary, in a diſeaſe that is ſo eaſily cured.

Beſides the ſeveral applications that we have mentioned, a variety of ointments and lotions are recommended by writers on dogs. Mr Beckford adviſes that as ſoon as a mangy ſpot appears on a hound, it ſhould be well rubbed with a liniment compoſed of a pint (mutchkin) of train oil, half a pint of oil of turpentine, a quarter of a pound of powdered ginger, and half an ounce of gunpowder. It is alſo recommended that the dog ſhould have a purging ball now and then, and ſhould be kept from fleſh meat. There is a variety of the mange in dogs, called the red mange, which it is ſaid is beſt cured by mercurial ointments.

335 Lice and fleas. Moſt of the domeſtic animals, eſpecially when young, are troubled with lice. Calves are ſometimes louſy, if they have been hard kept during winter, by being turned out in ſevere weather, fed on poor diet, and not kept clean. The beſt means of deſtroying theſe vermin is by rubbing their hide with an ointment compoſed of ſtaves-acre, or cayenne pepper, mixed up with hogs lard.

Young whelps are very ſubject to lice; but they may be eaſily removed by waſhing with a lotion formed by ſteeping a pound of tobacco in three Engliſh pints of ſmall beer, or by rubbing the ſkin well with train-oil.

Fleas are beſt deſtroyed by waſhing the dogs frequently with ſoft ſoap and water.

Sheep are often infected with vermin of various kinds, which haraſs the animals exceedingly; and not only do much miſchief to the wool, but even eat into the animal's ſkin.

336 Fly. The ſheep fly abounds moſt in the ſouthern parts of the iſland, and is chiefly troubleſome to lambs. The moſt effectual means of protecting the lambs from the inſect appears to be to ſmear the fleece with any kind of rancid oil.

337 Ticks. Another ſpecies of inſects that infeſt ſheep is commonly called tick, or kedd, the *hippoboſca ovina* of naturaliſts.

The ſmearing ointment generally prevents, or kills this inſect. But if this ſhould not happen, or if the ſheep are not ſmeared, inſects of every kind may be effectually killed, by ſlightly rubbing the parts affected with mercurial ointment, compoſed of three ounces of hogs lard, rubbed up with half a drachm of finely powdered corroſive ſublimate. To this may be added, a little of the ſpirit of turpentine. Coal-oil is powerfully deſtructive to inſects of every kind; but whether it may not prove injurious to the health or fleece of the ſheep, has not yet been aſcertained by experiment. A decoction or diſtillation from the gall-plant, which abounds in many moſſes and muirs, is known to be very fatal to inſects of every kind; and a ſheep may be ſafely waſhed with this juice. The juice of tobacco is alſo much recommended as a poiſon for thoſe inſects which infeſt ſheep.

The laſt ſpecies of inſects are chiefly hurtful to ſheep of a year old, or more. *

* *Findlater's Survey.*

Among the inſects which prove moſt troubleſome to horſes, ſheep, and cattle, are thoſe of the genus *Oeſtrus*, ſome ſpecies of which are generally known by the name of *gad-fly*. The beſt account of theſe inſects and their effects, that we have ſeen, is that of Mr Bracey Clark, publiſhed in the third volume of the Linnean Tranſactions, from which the following account is chiefly taken. Diſeaſes.

Mr Clark deſcribes five ſpecies of *Oeſtrus*, viz. *Oe. bovis*, *Oe. equi*, *Oe. hæmorrhoidalis*, *Oe. veterinus*, and *Oe. ovis*.

We ſhall at preſent deſcribe the effects only of the firſt and laſt ſpecies.

338 Gad-fly, or Oeſtrus bovis. The *Oe. bovis*, as its name imports, chiefly attacks cattle, through the ſkins of which it pierces, in order to depoſit its eggs. The pain which it inflicts in depoſiting its egg, appears to be much more ſevere than what is excited by any of the other ſpecies. When one of the cattle is attacked by this fly, it is eaſily known by the extreme terror and agitation that ſeizes the whole herd. The unfortunate object of attack runs bellowing from among his fellows, to ſome diſtant part of the paſture, or to the neareſt water, holding his tail, from the ſeverity of the pain, extended ſtraight from the body, in a line with his back, with a tremulous motion, and ſtretching out his head and neck to the utmoſt. The reſt of the herd, infected with the like fear, though not attacked, fly alſo to the water, or diſperſe to different parts of the paſture. "Such is the dread and apprehenſion in the cattle, for this fly, ſays Mr Clark, that I have ſeen one of them meet the herd when almoſt driven home, and turn them back, regardleſs of the ſtones, ſticks, and noiſe of their drivers; nor could they be ſtopped till they reached their accuſtomed retreat in the water."

When one of theſe flies happens to attack oxen that are yoked in the plough, there is often conſiderable danger, as the animals become quite ungovernable, and will often ruſh directly forwards with the plough, through hedges, or whatever oppoſes their career.

Heifers, ſteers, and the younger cattle, are in general moſt frequently attacked by this fly; the ſtrongeſt and moſt healthy beaſts ſeem conſtantly to be preferred by it, and this circumſtance is ſaid to be a criterion of goodneſs held in much eſteem by the dealers in cattle. Tanners alſo have remarked, that their beſt and ſtrongeſt hides have generally the greateſt number of holes in them.

The larvæ of this ſpecies, as of moſt of thoſe we are to mention, are generally termed *bots*, but this name is moſt frequently applied to the larvæ of the *Oe. equi*.

The complaint produced by the puncture of this inſect in the ſkins of cattle, is called *puckeridge*, and is not unfrequently attributed to the bite of the goat-ſucker. For the deſtruction of the larvæ thus depoſited, it has been recommended to inſert a red-hot wire into each of the holes made in the ſkin; but this is a formidable remedy, and will probably do as much harm to the ſkin as the bots themſelves. A more rational practice that is ſometimes in uſe, is to preſs the parts, and rub them well with a little oil of turpentine, or ſome other ſtimulating application, or a little oil of turpentine may be injected into each hole.

Diſeaſes.

The larvæ of the *Oe. bovis* are commonly known to the country people by the names of *wormils*, or *wormuls*, or *warbles*.

339 Oe. ovis.

During the ſummer, ſheep are often obſerved to gather together in cluſters, endeavouring carefully to guard their heads. Mr Bluine ſays that this is to protect themſelves againſt the attacks of this inſect, which attempts to lay its eggs on the inner margin of the noſe, which when it has effected, theſe eggs become larvæ, and creep up into the frontal and maxillary ſinuſes.

It is not eaſy to diſcover the manner in which this inſect depoſits its eggs, owing to its obſcure colour and rapid motions, and to the great agitation into which the ſheep are thrown by its attack; but the ſubſequent motion of the ſheep, and the manner in which they attempt to defend themſelves againſt their enemy, leave no room to doubt, that the eggs are depoſited on the inner margin of the noſtrils.

The moment the fly touches this part of the ſheep, they ſhake their heads, and ſtrike the ground violently with their fore feet, at the ſame time holding their noſes cloſe to the earth; they run away, looking about them on every ſide, to ſee whether the fly purſues: they alſo ſmell to the graſs, as they go, leſt one ſhould be lying in wait for them. As they cannot, like horſes, take refuge in the water, they have recourſe to a rut, or dry duſty road, or gravel-pits, where they crowd together during the heat of the day, with their noſes held cloſe to the ground, which renders it difficult for the fly conveniently to get at the noſtril.

Obſervations on theſe flies are beſt made in warm weather, and during the heat of the day, when by driving the ſheep from their retreats to the graſs, the attack of the fly, and the emotions of the ſheep, are eaſily obſerved.

The noſtril from repeated attacks, and the conſequent rubbing againſt the ground, becomes highly inflamed and ſore, which occaſions their touch to be ſo much dreaded by the ſheep.

It is ſaid that this fly alſo depoſits its eggs in the ſkin of the ſheep, but we are not certain how far this has been proved by experience; although there is no doubt that there are ſometimes found in the ſheep's ſkin, maggots that muſt have been produced from eggs depoſited by ſome inſect. They prove extremely troubleſome to the animal, eating into the ſkin, and producing ulcers. If not diſcovered in time they may even deſtroy the life of the ſheep. The remedy is to clip the infected parts bare, waſh them well with black ſoap and water, and apply the ſmearing ointment. If this does not ſucceed, recourſe muſt be had to the method recommended, in N° 337.

340 Pelt-rot.

When ſheep have lain about for a long time in wet and marſhy paſtures, or have been kept in woods or copſes in a ſtarving condition, their fleeces become ſo completely ſoaked with water, that the wool rots off from the ſkin. This is what is called the *pelt-rot*. If ſheep be ſuffered to continue long in this condition, they become heavy and low-ſpirited, and will ſooner or later be deſtroyed. If, however, they be attended to in proper time, they may be ſaved by driving them to a good ſtraw-yard, pulling off their ragged and rotten wool, and rubbing on a good coat of tar, greaſe, and turpentine. Care muſt alſo be taken, to provide them with plenty of good wholeſome nourihment.

The ſkin of all animals, eſpecially on the moſt delicate parts of it, is ſubject to excoriation or chafing. This is of moſt conſequence in the backs of horſes fretted with the ſaddle, and the udders of cows by rubbing againſt their thighs, when they are *cat-hammed*, and go cloſe behind. Both the udder and thighs of the cow are ſometimes quite raw, and ulcerated. The beſt remedy in theſe caſes, is to waſh the parts well with warm ſoap and water, and afterwards bathe them frequently with a mixture of Goulard, and camphorated ſpirits. Diſeaſes.

341 Excoriations, chaps, &c.

The teats of cows are ſometimes *chapped*, which is commonly owing to want of cleanlineſs in the milkers. When this happens, the treatment recommended above for *chapping* may be followed, or if this does not ſucceed, the teats may be anointed with what is called *unguentum nutritum*. If the teats are very painful, the cracks may firſt be bathed with a little laudanum, and afterwards filled up with finely powdered prepared chalk.

There are many other diſeaſes that affect the ſkin of theſe animals; but ſome of them are ſo trifling as not to require particular notice, and others being intimately connected with ſome general derangement of the ſyſtem, fall more properly to be conſidered in the next ſection of this part.

Chap. II. *Morbid Affections of Motion.*

342 The function of motion may be morbidly affected in various ways, but all theſe tend more or leſs to impede or diſturb the natural motions of the animal.

The muſcles are often affected with irregular motions, producing violent involuntary contractions, called convulſions or ſpaſms. Theſe are often ſymptoms of ſome dangerous derangement of the brain or nervous ſyſtem, as locked-jaw, epilepſy, canine madneſs, &c. Convulſions of this nature, being intimately dependent on the primary diſeaſe, can only be removed by ſuch means, as are calculated to carry off the diſeaſe, of which they are the ſymptoms. Irregular action of the muſcles commonly attends great debility, whether it be brought on by hard work and low diet, or by diſeaſe. In either caſe, it is commonly a very dangerous ſymptom. We cannot properly conſider the treatment of convulſion here; but it will be conſidered in the next ſection, when we come to treat of convulſive or ſpaſmodic diſeaſes.

343 Of lameneſs.

The affection that we are chiefly called to conſider in this chapter is lameneſs, a very comprehenſive term, as it includes almoſt all the local affections of the extremities. Lameneſs is a complaint that is exceedingly common among horſes and dogs, eſpecially the former; in whom it more particularly demands attention, as it ſo materially affects the value of the animal. A knowledge of the nature of lameneſs, and the method of treating it, can only be acquired by an inveſtigation of the cauſes by which it is produced.

The cauſes of lameneſs are extremely numerous and various. We ſhall endeavour to claſs them, ſo as to render our inquiry as little tedious and difficult as may be.

344 Stiffneſs.

1ſt, Lameneſs may be produced by a ſtiffneſs of ſome parts of the muſcles, tendons, or ligaments, ariſing either from exceſſive labour, from bruiſes, wounds, or ſome diſeaſed affection of the joints.

It

Diſeaſes.

It is well known, that when the muſcles of an animal are exerted for any unuſual length of time, or in a more than ordinary degree, they become fatigued, and cannot for ſome time perform their functions with their accuſtomed eaſe. In general, after proper reſt and careful treatment, the ſtiffneſs gradually goes off; and in a day or two the animal is able to exert himſelf as uſual; but if care has not been taken to rub him well down, and provide him with a well littered bed, and eſpecially if he has been expoſed to cold while ſweating and fatigued, this ſtiffneſs may continue for many days, or may even degenerate into permanent lameneſs. Animals that have acquired this permanent ſtiffneſs of their limbs, always move with conſiderable difficulty, when firſt taken out; but in general when they have been long in exerciſe, and are become warm, the ſtiffneſs and lameneſs in a great meaſure diſappear, but they commonly return again when the exertion is over.

Where the ſtiffneſs has not continued long, it may in general be eaſily removed, by frequent friction of the limbs, firſt with a wiſp of hay and the bruſh, and afterwards with ſome warm liniment or embrocation, ſuch as has been deſcribed among the ſtimulant receipts.

If it does not yield to this treatment, recourſe may be had to warm fomentations, and gentle exerciſe muſt be perſiſted in. If the lameneſs ſhould ſtill continue, it will probably be occaſioned by a ſtrain of ſome ligament, or an injury done to ſome part of the limb.

345
Bruiſes.

Any of the muſcular parts may be bruiſed by falls or blows; and if the bruiſe takes place on the limbs, or in their neighbourhood, lameneſs may be the conſequence. A bruiſe is almoſt always followed by a ſwelling of the bruiſed part, occaſioned by the rupture of ſmall veſſels, that pour out their fluids into the cellular membrane. If the bruiſe is ſlight, the ſwelling will ſoon ſubſide; but if the injury has been conſiderable, and much blood has been poured out, inflammation and conſequent ſuppuration will take place, and the part will become an abſceſs. If the injury has been ſtill greater, and the texture of the parts has been deſtroyed, mortification will probably come on, and if the bruiſe be extenſive, will be attended with conſiderable danger.

The treatment of bruiſes will be different according to the degree of the injury produced. In ſlight caſes the object will be to promote the abſorption of the effuſed blood; and this will be beſt anſwered by bathing the part with warm vinegar and water, or camphorated ſpirit. If there is conſiderable inflammation, and it is not judged proper to encourage a ſuppuration, the parts muſt be frequently bathed with a ſolution of ſugar of lead, with a little vinegar; or, where the part admits of a bandage, it will be better to form a cold poultice of oatmeal mixed up with ſuch a ſolution, and kept conſtantly applied to the part and frequently moiſtened with the ſolution to prevent its becoming hard and dry. If a ſuppuration ſhould appear unavoidable, it will be proper to encourage it by a frequent application of warm poultices renewed as often as they become cool, or, where theſe cannot be applied, by repeatedly fomenting the part with flannel wrung out of warm water. When the ſuppuration is complete, the ſwelling muſt be opened with a lancet, or by means of a ſeton; and the ſore muſt be treated as we ſhall preſently deſcribe with reſpect to ulcers. If mortification takes place, the parts muſt be frequently fomented with the fomentation directed in N° 57. of the receipts; and the animal's ſtrength muſt be ſupported by nouriſhing food, and the occaſional uſe of cordial and ſtrengthening remedies. If the mortified part be very extenſive, it may be neceſſary to make inciſions towards the edges with a knife, to promote the ſeparation of the ſlough; or firing may be employed, as directed for this purpoſe in N° 175.

Diſeaſe

It ſometimes happens that after the inflammation which attended a bruiſe has ſubſided, a permanent hard tumour is left, that prevents the free motion of the muſcles of the part. This may ariſe either from a thickening of ſome ligament, or the cellular texture, or it may proceed from an excreſcence formed on the bone, in conſequence of the bruiſe. The treatment in ſuch caſes will be preſently deſcribed, when we come to conſider ſplents, ring-bones, and other tumours that commonly produce lameneſs.

346
Tread, or overreach.

Horſes are very liable to receive ſevere bruiſes in the back part of the foot, either from the tread of another horſe, as often happens in the army, by a horſe in the rear-rank treading on the heels of one in the front-rank; or, by a horſe overreaching his hind foot, and thus bruiſing the heels of the fore foot. From the manner in which this accident is produced, it has received the names of *tread*, and *overreach*. Sometimes the bruiſe is ſo ſlight as to be productive of no farther ill conſequence than a temporary lameneſs; but if the tread has been very violent, the edges of the part trodden on may be ſo much bruiſed as to produce conſiderable inflammations, or even a mortification. In ordinary caſes it is ſufficient to waſh the part carefully with warm water, to clear it of dirt and gravel, then apply a pledget dipped in ſpirits, and bind up the foot, ſo as to exclude the external air; when the bruiſe, if ſlight, will probably ſoon heal. But in ſome caſes matter is formed, which makes its way downwards towards the ſole, forming what is called a *quittor*. Quittor may alſo take place from a puncture in the foot, by a nail or other pointed body, the effects and treatment of which will be preſently deſcribed.

347
Quittor.

In a newly-formed quittor, it is of conſequence to aſcertain, whether it has been produced by a prick or a tread. In the former caſe the matter uſually makes it way upwards from the punctured part towards the coronet; and here the practice generally followed by farriers is, to ſear the upper orifice with a hot iron, which anſwers no other purpoſe than to confine the matter within the wound, where it muſt produce extenſive ulceration and deſtruction of important parts of the foot. In the latter caſe, where quittor is produced by a tread, and where the ſinus formed is very ſuperficial, the uſe of the cautery may be very proper; and if it can be ſo applied as to inflame the whole extent of the wound, it may entirely carry off the diſeaſe. According to Mr Blaine, there are too general methods of curing quittor; one by removing a part of the hoof, cutting away the diſeaſed parts, or ſuffering them to ſlough off or exfoliate. The other, to apply cauſtic to the diſeaſed ſurfaces, introducing it within the ſinuſes, thus deſtroying the ulcerated parts, and allowing the healthy parts to throw them off. The latter is called by farriers *coreing out a quittor*, as they ſuppoſe that the

Diſeaſes. the core or ſlough that comes away formed a part of the complaint. Mr Blaine objects to removing the hoof, as it would take up a conſiderable time before new horn can be formed; and it is probable that in the new hoof there will be a falſe quarter, which will render the horſe unſound, beſides that, during the formation of the new hoof, freſh ſinuſes may be produced. In the method of cure by cauſtic, he thinks that the diſeaſe may be completely removed in three or four weeks, whereas the other method may require as many months. The mode of applying the cauſtic is, to examine carefully the extent and direction of the ſinuſes, and then to fill them up with powdered blue vitriol, verdigriſe, or corroſive ſublimate. Mr Blaine has found that a paſte made of corroſive ſublimate, mixed up with flour and butter, forms a very good cauſtic for this purpoſe. Some of it is to be introduced by means of a probe, to which a piece of ſponge is faſtened, which muſt be carefully introduced in every direction, ſo as to touch all the diſeaſed parts, after which the whole foot is to be bound up; but the bandage muſt not be applied too tightly. In two or three days the dreſſings are to be renewed, and this is to be repeated at intervals till the ſloughs come away, when a healthy action of the parts will take place, and the cure ſoon be completed. Another method of introducing cauſtic, by which the ſinuſes may be completely filled, is to mix up the cauſtic with hogs lard, and roll the maſs into ſmall pellets within gauſe-paper, which may be eaſily introduced into the cavities.

Many farriers have fallen into a miſtake with reſpect to the nature and treatment of *quittor*, that has been the ruin of many horſes. They ſuppoſe, that during the progreſs of this diſeaſe, a bone is formed which they call a *quittor bone*; and they think it neceſſary to remove this bone, before a cure can be completed. This error ſeems to have ariſen from an opinion of Lafoſſe, who conceived that the derangement which accompanied this diſeaſe originated in the cartilages being affected; which he affirmed were capable of being thus diſeaſed, but incapable either of exfoliating like bone, or ſloughing like ligament; and therefore that to promote a cure, the whole of the lateral cartilage on the affected ſide muſt be removed. But his firſt premiſes were erroneous, for cartilages are vaſcular, as we know by their being tinged with bile, and by their being at times abſorbed; this is particularly the caſe with the lateral cartilages, which in almoſt all old horſes are partly abſorbed. As they are vaſcular, they muſt be capable of living action; though it is ſlow, and hence where diſeaſe exiſts, they will exfoliate like other parts. This practice of Lafoſſe has in this country been for ſome time tried among many of the more intelligent farriers, and was ſtill further propagated by the late Profeſſor St Bel. Many horſes have been ruined by this injudicious practice; for the future elaſticity of the foot, which is in a great meaſure dependent on theſe cartilages, muſt be loſt; beſides the neceſſary removal of the hoof to get at the cartilage, a falſe quarter almoſt always remains *.

* *Blaine's Outlines*, vol. ii.

348 Wounds.

Wounds are frequently inflicted in the ſoft parts of horſes and dogs, and theſe are more common in the legs, feet, and joints, than in any other parts. The treatment of wounds muſt depend in a great meaſure on the part where they are inflicted, and the form of the inſtrument that produced them. A clean cut made in the muſcular parts is eaſily healed, by applying ſlips of ſticking plaſter as ſoon as poſſible, ſo as to keep the edges of the wound cloſe together; or where plaſter cannot readily be applied, by taking a ſtitch or two through the edges of the wound, and tying the ſtrings gently together. When the edges are found to adhere, the ſtrings muſt be cut away, and the holes which they made will ſoon fill up. If any conſiderable blood-veſſel has been wounded, it will be proper to ſecure it, if poſſible, by means of ligature, rather than by applying any ſtyptic ſubſtance. All wounds ſhould be made as clean as poſſible, before any attempt is made to heal them. Sometimes the wound is ſo ſituated that it will not admit of being ſewed up; but in theſe caſes we may in general paſs ſilver or ſteel pins from the edges, at about an inch diſtance from each other, and twiſt a thread croſſwiſe from one to the other, ſo as to form what is called the *twiſted-future*. In all caſes where futures are uſed, it will be proper to apply a ſticking plaſter over the edges of the wound. If the wound ſhould not heal by theſe means, a formation of matter will take place, and then the ſore is to be treated as a common ulcer, taking care that its edges be always kept as near together as may be, by ſticking plaſter or a bandage. Diſeaſes.

If the wound is very large, it may excite conſiderable inflammation and fever. In theſe caſes, if the animal is plethoric, it will be proper to bleed him, or at any rate to adminiſter cooling remedies. If, on the other hand, there has been much loſs of blood, or if the wound ſhews no diſpoſition to heal, and the matter formed is thin and ichorous, an oppoſite plan of treatment will be required. The animal muſt be ſupported by nouriſhing food, and ſtrengthening remedies.

The moſt troubleſome wounds are thoſe of the feet and joints, as they are in general very difficult to be healed.

349 Wounds of the feet.

Wounds in the feet are not uncommonly produced by the horſe treading on ſharp ſtones, broken glaſs, ſharp bones or nails. Theſe are generally punctured wounds, and will be conſidered preſently. Sometimes a deep wound is made on the coronet, by a ſharp part of the heel of the ſhoe on the oppoſite foot, or any other ſubſtance penetrating downwards between the coffin-bone and the hoof, or between the lateral cartilages of the coffin-bone and the joint. Wounds of this kind are attended with much danger, from the difficulty of evacuating the matter that may be formed, or of producing that healthy action in the parts that is neceſſary to make them heal. In ſuch caſes Mr Feron recommends the application of a bliſter, extending from the fetlock to the foot, ſo as to produce external irritation, which may relieve the internal parts. In the mean time the foot is to be kept in a veſſel of warm water all day, and a large warm poultice of bran and water is to be applied round it at night. The intention of this practice is to prevent ſuppuration, but if this ſhould, nevertheleſs, take place, and if matter ſhould be formed between the hoof and the ſenſible lamina; the ſuppuration is to be encouraged, and we are to endeavour to prevent the formation of ſinuſes, by raſping the hoof very thin, juſt below the ſeat of the wound, ſo that we may be able to make an orifice for the evacuation of the matter downwards. Mr Feron adviſes

Diſeaſes. adviſes to delay this opening as long as poſſible, and when it is performed, to take care that the laminæ be properly preſſed after the operation, to prevent coming out through the hoof, and forming an incurable ſand-crack, or falſe-quarter. The bathing the foot in warm water, and the application of the bran poultice, muſt be continued till the foot is perfectly healed. If proud fleſh ſhould appear through the opening that has been made in the hoof, it is to be pared away with a ſharp knife, then fired, and covered with a ſmall pledget ſpread with ſoft ointment, on which is ſprinkled a little powdered blue vitriol. It is evident that, during the cure, the horſe muſt be kept perfectly at reſt; and it is recommended to adminiſter diuretics, and now and then a gentle doſe of phyſic, to keep the bowels moderately open.

350 Wounds of the joints. Wounds in the joints are commonly attended with very ſerious conſequences, as it frequently happens that the capſular ligament is divided, and in this caſe the ſynovia or joint-oil conſtantly exſuding through the opening, prevents the diſpoſition to heal. A wound in the joints is common among horſes in the army, and ſuch as are employed in hunting; and a horſe that has received ſuch a wound in general becomes perfectly uſeleſs, from the improper method of treating theſe wounds that has in general prevailed among farriers. By their treatment, either an incurable ſinus is produced, or a ſecretion of bony matter takes place within the joint, forming what is called an *anchyloſis* or *ſtiff-joint*. The method generally practiſed by ordinary farriers is, to inject within the joint a mixture of turpentine and oil of vitriol, a ſolution of corroſive ſublimate and lime water, or ſome other corroſive ſubſtance. The more rational of them content themſelves with an injection of tincture of myrrh. All theſe ſubſtances produce ſuch a high degree of inflammation within the joint, as not unfrequently to deſtroy the animal.

Of late, a much more rational mode of treatment has been adopted by Mr Coleman, and is deſcribed in the firſt number of the Veterinary Tranſactions.

351 Mr Coleman's method of treating wounds of the joints. The following is the method recommended by Mr Coleman for treating wounds of the joints and capſules.

"Where a joint, a mucous capſule, or the ſheath of a tendon is opened, the firſt application neceſſary is the actual cautery. The inſtrument moſt proper for the operation ſhould be made of iron, two feet in length, rounded at the extremity about the ſize of a ſmall button, with a wooden handle. The temperature of the iron ſhould be moderately red. If it be black, the heat will not be ſufficient to produce a proper diſcharge of lymph, to cloſe up the wound; and if it is white, it will deſtroy too much of the ſurrounding parts, and perhaps do miſchief to the ligament. Although the operation in itſelf is very ſimple, yet ſome knowledge of the ſtructure and economy of the parts, for the purpoſe of applying the cautery with the beſt poſſible effect, is neceſſary. The object in view is to produce a glutinous ſubſtance to cloſe up the cavity, and before the ſlough is removed, for granulations below to ſupply the place of the lymph; but if the ligament itſelf be deſtroyed by the cautery, it muſt, like other dead parts, ſeparate from the living and come away, and then the joint will ſtill be opened. It is, therefore, of importance not to deſtroy the ligament of joints with the hot iron, but confine its application to the external ſoft parts. In Diſeaſes. theſe caſes, it is generally proper to cauterize the whole external ſurface of the wound; and if the diſcharge is not immediately ſtopped, the iron has probably not been applied ſufficiently deep, or too cold, to produce a proper diſcharge of lymph. Where a cure is poſſible to be effected, the actual cautery will frequently cloſe the cavity and ſtop the diſcharge. Sometimes, however, in the courſe of one, two, or three days, the diſcharge appears again by the ſides of the lymph, and then the ſame operation ſhould be repeated. In ſome inſtances Mr Coleman has had occaſion to apply the hot iron five or ſix times, and nevertheleſs ſucceeded ultimately, without the leaſt lameneſs. The ſame treatment is likewiſe to be recommended for penetrating wounds into the cheſt and abdomen. The lips of the wound ſhould be cauterized, and, if requiſite, repeated in the ſame manner as is recommended for wounds of other cavities. When the cavities of veins become inflamed, ſome little variation is neceſſary in the treatment, as accidents of that nature are frequently attended with conſequences different from the opening of other cavities, and require a trifling alteration in the treatment. When a hemorrhage takes place, it may be very generally ſtopt by the application of the cautery; but if this fails, and the parts are too much ſwelled to admit of a pin, there is no other remedy than to take up the vein by a ligature above the diſeaſed parts; and there may be inſtances in which it may be adviſable to tie up the vein below. In general, however, the actual cautery will prevent the neceſſity of a ligature; and if it fails, tying up the vein will ſucceed only in thoſe caſes where the vein above is free from diſeaſe. In general, the vein is thickened and inflamed, and if a ligature be applied on a veſſel in a ſtate of inflammation, the diſeaſe will be formed, and the vein inflame above. In a caſe that occurred to Mr Goodwin, veterinary ſurgeon at Oxford, where the jugular vein was tied, an abſceſs took place over the occipital bone, commonly termed the *poll evil*. That diſeaſe, however, moſt probably did not originate in conſequence of the tube being obliterated, for in moſt ſucceſsful caſes of inflamed veins, the ſides of the vein unite and deſtroy the cavity. After the orifice of the inflamed vein, from the application of the actual cautery, is cloſed, a conſiderable degree of ſwelling frequently remains, and this may be removed by a bliſter. When abſceſſes form in the adjacent parts, they ſhould be treated in the ſame manner as common abſceſſes."

352 Punctured wounds. A puncture of ſome part of the lower ſurface of the foot is a frequent occurrence. It may ariſe from the prick of a nail in ſhoeing, from a nail picked up in travelling; or from glaſs, flint, or any other ſharp body. Injuries of this kind are proportioned in their effects, to the parts punctured, and not entirely to the depth of the wound. A puncture of the frog penetrating even to the fleſhy frog, is not uſually ſo ſerious, as that which penetrates the ſole; hence a wound any where at the hinder part may penetrate deeper with impunity than towards the centre, and likewiſe in the front, though conſiderable inflammation uſually follows from this laſt. When the capſular ligament is wounded in theſe caſes, the conſequence may be very ſerious, as a ſtiff joint is commonly produced. When it is found that the capſular ligament has been wounded, the external opening muſt be enlarged, and a hot iron muſt be applied to the

Diſeaſes. the ſurface of the ſkin that covers the wounded part of the ligament, in order to heal up the internal opening. Conſiderable irritation commonly attends a punctured wound of the tendon, or its ſheath; and it is beſt removed by enlarging the wound that is made through the horny part, and keeping the feet for ſome time in warm water. When matter appears in either of theſe caſes, it muſt be let out, and the wound muſt be healed in the uſual manner.

The moſt uſual caſe of punctures is that which ariſes from a nail in ſhoeing taking a wrong direction, when inſtead of penetrating the outer ſurface of the cruſt, it turns inwards, and thus wounds the ſenſible laminæ. This is known to the ſmith at the time by a peculiar feel in the ſtroke he gives, and by the flinching; when, if the nail is immediately removed, and has not penetrated far, the wound heals by the firſt intention; but if it is ſuffered to remain, it produces inflammation and ſuppuration. As ſoon as this is diſcovered, a depending orifice ſhould be made for the matter, by making an opening in the line of the hole at which the nail entered. It is always prudent, when a nail has penetrated, and lameneſs follows without matter appearing, to remove the ſhoe, and enlarging the opening to apply a pledget of tow dipped in ſpirits of wine, which will frequently prevent any future effects: but whenever matter has formed, it is indiſpenſably neceſſary; for otherwiſe the matter will proceed upwards, and coming out at an opening on the coronet, it will form a quittor. When by this treatment the matter has gained a depending ſituation, and the inflammation has ſubſided, the part may be dreſſed with any mild ointment; but if the matter ſhould increaſe in quantity, it will be proper to pour a ſolution of white vitriol within to promote a ſtoppage of the diſcharge, and of the extenſion of the ulcerative proceſs. In every puncture, when the heat and inflammation appear conſiderable, bleeding at the toe is a prudent meaſure, as it unloads the veſſels.

Dogs are frequently wounded with thorns in their feet or knees, and the thorn may be ſo deeply lodged, that it cannot eaſily be extracted. When the foot is wounded with a thorn, the beſt application is a plaſter of black pitch, which is ſaid to have ſucceeded when every thing elſe has failed. If there is much inflammation, it will be proper to apply a poultice over the plaſter. When a dog is wounded in the knee, if there is reaſon to ſuppoſe that a thorn is left in the wound, the ſame applications will be proper; and when the thorn comes away, if there is ſtill an oozing of fluid from the orifice, a red-hot iron muſt be applied, as in the wounds of the joints in horſes. If no thorn is left in the wound, a little digeſtive ointment rubbed upon the part, and a ſubſequent application of a poultice made with Goulard and crumbs of bread, with proper reſt, will probably ſoon effect a cure.

Lameneſs is not unfrequently produced by a ſtiff joint, or what the ſurgeons call *anchyloſis*. This is generally the effect of an injury done to the articulating ſurfaces of the bones that compoſe the joint, cauſing the formation of new bony matter, which gets between the bones, and unites them together. A ſtiff joint may perhaps be ſometimes prevented by the timely uſe of bliſters and firing; but when completely formed, the lameneſs is incurable.

2. The ſecond head of cauſes that produce lameneſs will comprehend ſtrains, fractures, and luxations. Diſeaſes.

Strains may take place in any of the muſcular parts or ligaments, but they moſt commonly happen in the fleſhy part of the ſhoulder, or in ſome of the ligaments of the feet. 354 Strain

A ſtrain in the muſcles of the ſhoulder, has been generally called a ſhoulder-ſlip, under the idea that the ſhoulder-bone has been disjointed, or the blade-bone puſhed out of its place; but the ſtructure of the parts ſhews that the former of theſe accidents can ſcarcely happen, on account of the great ſtrength of the capſular and other ligaments that ſurround the ſhoulder joint; and a diſlocation of the blade-bone is, by the extent and ſtrength of the muſcles that unite it with the ribs, nearly impoſſible, unleſs by ſuch a force as is ſufficient to deſtroy the texture of the muſcles, and tear the limb from the body. A ſtrain of theſe muſcles, and of the ligaments that ſurround the ſhoulder joint, is, however, by no means an unfrequent occurrence, but affections of other parts are often miſtaken for a ſhoulder ſtrain, as we ſhall ſee preſently. A ſtrain in the ſhoulder, when firſt received, is generally attended with conſiderable inflammation and ſwelling of the part, which are uſually ſufficient to diſtinguiſh it from other affections. When the ſtrain has continued long, and the inflammation has ſubſided, the diſtinction is not ſo eaſy. 354 Shoulder-ſlip.

In caſes of recent ſhoulder ſtrains, it will be proper to draw blood from the plate vein, and if the inflammation is extenſive, to adminiſter a purge, and keep the animal rather low, to keep down the inflammation as much as poſſible; and it will be proper to bathe the parts frequently, with ſome aſtringent lotion, or with a warm fomentation, as directed under *bruiſes*. A rowel may alſo be placed in the cheſt, or a ſeton in the inſide of the fore-leg. Complete reſt is neceſſary; and to render this the more perfect, the horſe ſhould be fitted with a patten ſhoe, and ſhould have a bed of litter conſtantly below him. When the inflammation has ſubſided, gentle friction, and the occaſional uſe of aſtringent lotions, will in general ſoon reſtore the uſe of the limb; and as ſoon as the horſe can bear it, moderate exerciſe may be employed.

Injuries done to the ligaments and tendons, are alſo uſually called ſtrains; but if we underſtand by this term, an extenſion of the ſtrained part, the appellation is improper, ſince the tendons appear to be entirely without elaſticity, and the ligaments nearly ſo. Theſe parts cannot, therefore, be properly ſtrained, though by unuſual exertion, their texture may be ſo far injured as to produce ſtiffneſs, inflammation, and ſwelling, but will have the ſame effect in cauſing lameneſs, as a ſtrain. 355 Injuries of the ligaments and tendons.

Injuries of this kind are more dangerous than mere muſcular ſtrains, their treatment is more difficult, and the cure more tedious. The treatment uſually adopted by ordinary farriers, is to apply the ſame aſtringent and ſtimulating lotions, as in ſtrains; but here they commonly do harm, as they generally produce a greater ſecretion of coagulable lymph, which ſtill more obſtructs the motion of the part, and renders the lameneſs permanent.

One of the worſt caſes of theſe injuries, is what far-

Diſeaſes.

356 Clap or ſtrain in the back ſinews.

riers commonly call a clap or ſtrain in the back ſinews. When a horſe trips or ſtumbles, and makes an unuſual effort to ſave himſelf from falling, or when the heels are lowered in ſhoeing too ſuddenly, or too much at once, ſo as to throw too great a weight upon them, there often happens ſuch a ſudden or violent contraction of the flexor muſcles as may produce a partial laceration, or even rupture of the flexor tendon, or its ſheath. This injury is attended with conſiderable inflammation, and the conſequent lameneſs is of the worſt kind. A great ſtiffneſs and ſwelling is produced, and there is commonly an effuſion of fluid, which is at firſt ſerous, and may again be taken up by the abſorbent veſſels; but if improper applications are employed, coagulable lymph may be poured out, ſo as to obſtruct the motion of the part, and produce that ſwelling, or permanent enlargement, that we ſometimes ſee in the neighbourhood of the tendon, after what is called a ſtrain of the back ſinews.

When a horſe is ſtrained in the back ſinews, he puts forward his leg and foot in a looſe, faint, and faultering manner. Mr Lawrence gives the following directions for aſcertaining whether or not a horſe is injured in the back ſinews. To try how far the horſe has been injured, let him be walked about for half an hour, when the ſwelling of his legs will in all probability ſubſide. If you then obſerve the *tendo achillis*, or main ſinew, diſtinct from the ſhank; if, on preſſing it with the finger towards the bone, you find it firm and tenſe; if you diſcover by the feel, no ſoft ſpongy ſinews between the ſhank and the tendon, no extraordinary pulſation, but that all is well braced and wiry, you may conclude the ſwellings not dangerous. A perſon of experience, with a nice diſcriminating finger, will ſcarce ever fail to detect lameneſs in the back ſinews.

Mr Feron is of opinion that the injury which we have deſcribed is not done to the flexor tendon, but to the ligaments of the neighbouring joints. He ſays, that "on the diſſection of a ſtrain ſuppoſed to be in the back ſinews, we diſcover no affection in the ſubſtance of this part, which on the contrary appears perfectly ſound. But on examining the ligaments of the fetlock, coronet, and foot, we find them to be the ſeat of the diſeaſe; we find alſo, that if the accident has been violent, and of long duration, the whole vaſcular ſyſtem of the leg is found affected, but never, or very ſeldom, the back ſinews; it is in this violent ſtate that we obſerve ſometimes one or two ſwellings along the tendons. It is alſo on this account that the pain is ſo great, and ſo hard to be cured, in conſequence of the conſiderable irritation which takes place in the ſurrounding parts. So the increaſe of thickneſs of the leg, is nothing more than the effect of the diſeaſe; but not the diſeaſe itſelf, as farriers, grooms, &c. ſuppoſe it to be. Nevertheleſs, we ſaid before that the back ſinews or tendons were void of feeling in a ſtate of health and incapable of extenſion *." It may be very true that this injury is not commonly ſeated in the tendon; but we cannot agree with Mr Feron, that this part is never the ſeat of it, eſpecially as he himſelf allows that a rupture of the tendon may take place, of which he has ſeen different inſtances. It is not difficult to conceive that the ſame exertion which when in a great degree is capable of rupturing the tendon, may in a ſmaller degree produce a partial laceration, or a ſtrain in the back ſinews.

* *Feron's Farriery*, p. 104.

Diſeaſes.

A horſe labouring under this injury, even after the inflammation has ſubſided, is extremely weak and ſtiff in the joints of the foot; but when he has been for ſome time at work, the lameneſs in ſome meaſure goes off. This has led ſome perſons to ſuppoſe that a ſtrained horſe may be worked ſound; but this is a very erroneous opinion, and the practice of continuing to work a horſe that has been newly ſtrained, under the idea of removing the ſtiffneſs, is equally cruel and injudicious.

The treatment of ſtrains or injuries of the ligaments or tendons muſt be ſuch as will moſt effectually prevent inflammation, and promote the abſorption of the effuſed fluid. Local bleeding from the veins of the part, and warm fomentations frequently repeated, ſeem to be the moſt adviſable; and a bandage ſhould be always applied where the nature of the parts will admit of it, and ſhould be continued till the lameneſs is removed. Various ſtimulating applications have been recommended in theſe caſes, as ſoon as the inflammation has ſubſided, ſuch as oil of turpentine, camphorated ſpirit, verjuice, &c. but theſe muſt not be employed while any conſiderable inflammation remains. It is ſomewhat remarkable that Mr Feron recommends aſtringent and ſtimulating applications in the text of his work, and ſays there that they may be employed with ſafety; but, in a note at the foot of the page, he ſpeaks of having inſerted thoſe aſtringent preſcriptions for the purpoſe of ſatisfying the different opinions, but that he is fully convinced, by a long experience, that warm fomentations and warm poultices of bran and water, are infinitely preferable in ſtrains or contuſions, to theſe expenſive preſcriptions, and are always to be tried firſt.

It will be proper to elevate the heels of the horſe's ſhoe by calkins, and Mr Blaine recommends that the heels of the hoof be encouraged to grow, or that a thick-heeled ſhoe be uſed. If there ſtill remains much ſwelling, firing will prove one of the moſt effectual remedies, as it will both promote the abſorption of the effuſed fluid, and will produce ſuch a degree of conſtriction of the ſkin as will anſwer the purpoſe of a permanent bandage. In ſuch caſes the cautery muſt be applied, ſo as to make perpendicular lines on the ſkin.

357 Strains of the ſtifle in dogs.

Dogs are very ſubject to ſtrains; and where theſe are of ſlight, a mixture of ſpirit of wine and oil of turpentine, or ſtrong Goulard, applied before a fire, is the moſt uſeful remedy. Sometimes from blows or other accidents, ſuch as ſlipping their hind-legs, or getting them entangled in the bars of a gate, hounds are lamed in their *ſtifle*, as it is called. In general the above applications and long reſt will remove the lameneſs; but when a conſiderable quantity of coagulable lymph has been effuſed, it is not eaſily re-abſorbed, and the lameneſs continues. When this happens, ſome huntſmen recommend the operation of cutting for the ſtifle, and Mr Daniel ſpeaks of a huntſman who uſed to perform this operation very dexterouſly in the following manner. The bone is laid bare by a tranſverſe cut, and upon it is found a ſubſtance like a ſtiff jelly, which is the cauſe of the lameneſs, and is in fact the coagulable lymph that has been effuſed. This jelly is taken away, and a wire is run through the ball of the hind-foot on the contrary ſide, and twiſted in ſuch a manner as to keep that leg from touching the ground, ſo that the hound may be compelled to uſe the ſtifled leg. In this way the dogs were always cured. The ſame huntſman recommended that

Diſeaſes. that when a dog had been entangled in a gate or ſtile, he ſhould, as ſoon as releaſed, be taken by the hind-feet, and twiſted round five or ſix times, turning with him; and it is ſaid that this prevented any ill conſequence from the bruiſes that he received in the ſtile, while endeavouring to diſengage himſelf.

358 Some of the ligaments or tendons of the extremities are now and then ruptured. This is not a common caſe, but it may happen, either to the ſuſpenſory ligament, or the back ſinew.

359 Rupture of the ſuſpenſory ligament. A rupture of the ſuſpenſory ligament is found moſt likely to happen to young horſes while breaking, and to cavalry horſes while under training. The accident is generally called *breaking down*, as, when it happens the horſe appears unable to ſupport himſelf. The fetlock is brought almoſt to the ground, and the limb is evidently exceedingly weak; but the horſe can bend his foot when he raiſes it. This circumſtance diſtinguiſhes a rupture of the ſuſpenſory ligament from that of the flexor tendon or back ſinew; as, in the latter caſe, the power of the flexor muſcle being deſtroyed, the horſe is unable to bend the foot.

It appears from the obſervations of Mr Coleman, and ſome experiments that have been made by Mr Feron, that the flexor tendon has little or no effect in giving ſupport to the heels; but that this office is almoſt entirely performed by the ſuſpenſory ligament. Hence, when this is ruptured, the horſe loſes one of his principal ſtays, and the foot is of courſe unable to ſupport its uſual weight, whence the horſe breaks down.

A perfect cure of this accident can ſeldom be expected; and the only way to relieve the animal will be to obviate the inflammation as much as poſſible, and to elevate the limb, and eſpecially to raiſe the heels, in order to relax the injured parts. An intermediate ſubſtance will in time be produced between the two parts of the broken ligament, that will enable the horſe to walk and perform ſome of his functions, but he can never afterwards be depended on for the road or the field.

360 Rupture of the back ſinew. When it is aſcertained that the back ſinew has been ruptured, which is diſcovered by the inability of the horſe to bend his foot backwards, it is generally recommended to kill the horſe, as a cure is by moſt deemed impracticable. Mr Blaine recommends to bend the limb from the ancle downwards, and to keep it in that ſituation by throwing the animal, when he thinks that a perfect cure might be made. There would, however, be conſiderable difficulty in keeping the limb in ſuch a confined ſituation for ſo long a time as would be neceſſary to unite the ruptured tendon; and after all, there is the greateſt probability that a very ſlight exertion would produce a freſh rupture.

361 Fractures. Fractures of the bones may take place in any part of theſe animals, but they are moſt common in the feet of horſes and the legs of dogs.

The navicular, coffin, and ſmall paſtern bones of a horſe are not unfrequently fractured, and Mr Feron ſpeaks of a ſmall paſtern bone being broken into ſeven pieces. It is not ſurpriſing that theſe bones ſhould be broken, when we conſider the immenſe weight that is generally ſuſtained by them, and the great exertions which a horſe ſometimes makes to recover a falſe ſtep.

Theſe bones, when broken, will be united by a callus, provided that the limb be kept in ſuch a ſituation as to prevent motion; but this can rarely be effected, even in caſes where the bones of the foot are fractured, ſtill leſs in theſe caſes where a fracture of the larger bones has taken place. Diſeaſes.

362 Fractures of the haunch-bone. One of the moſt common fractures of the bones in a horſe is that of the ridge of the ilium, or haunch-bone. This bone, from the projecting angle formed by its ridge, is peculiarly expoſed to injury; and when the ridge is unuſually prominent, as ſometimes happens, or when the horſe is more than commonly lean, the probability of fracturing this bone is ſtill further increaſed.

Fractures of the haunch-bone may be occaſioned by falls, by blows, which are often given by brutal oſtlers and carters, with the but end of a large whip, or perhaps a broomſtick, and they are very commonly produced by ſtriking the haunch violently againſt a poſt, or the edge of a wall, when the horſe turns too ſharply round a corner, or paſſes ſwiftly through a narrow gateway.

It may be aſcertained that ſuch an accident has taken place, by the pain the horſe feels in the part, and where the fracture is conſiderable, by the cracking of the parts of the broken bone againſt each other, but ſtill more certainly by an evident cavity of the haunch, from the depreſſion of the ridge. The muſcles of the belly in the upper part of the flank will appear ſunk in, eſpecially when the horſe lies down, and will form a ſort of hollow between the haunch and the ribs. The horſe, when he attempts to move, will be as lame as if one of the bones of the leg were broken, owing to the extreme pain that motion excites in the muſcles, that beſide being ſeverely bruiſed, have loſt one of their principal attachments.

When an accident of this kind has happened, it is neceſſary to keep the animal perfectly at reſt, as nothing but repoſe can produce a reunion of the fractured bone. The parts may be gently rubbed with ſome ſtimulating liniment, as in other caſes of bruiſes, and ſome recommend the application of a charge, or ſtrengthening plaſter. It ſometimes happens, where only a ſmall part of the bone has been broken off, the horſe completely recovers his former activity; but more commonly ſuch a deformity is produced by the ridge of one haunch remaining lower than that of the other, and by the callus that forms between the end of the divided bone, as to render the horſe more or leſs permanently lame.

When the legs of a dog are broken, it is eaſy, by means of ſplints, to keep the limb in ſuch a ſituation as to effect a union of the broken bone; and we have not unfrequently met with caſes of this kind, where a complete cure has been effected in the courſe of a few weeks.

The ribs of a horſe are ſometimes broken, either by falls, or from the brutality of their keepers, as by ſtriking them with the heavy handle of a whip or cudgel. If the end of the fractured rib does not penetrate into the cheſt, ſo as to wound the lungs, a cure may in general be readily effected, by faſtening a bandage round the body over the ſeat of the fractured rib, and keeping the horſe at reſt and on a low diet.

363 Luxations. Luxations or diſlocations of bones are exceedingly uncommon in the horſe, owing to the great ſtrength of the

Diſeaſes. the ligaments that ſurround the joints. Theſe may, however, ſometimes happen, and we are by no means of Mr Blaine's opinion, that the immenſe ſtrength of the muſcles in a horſe would prove any obſtacle to the complete reduction of ſuch a luxation. If, indeed, we endeavoured to reduce the luxation by pulling and hauling at the luxated limb, in order to overcome the power of the muſcles, and thus produce a counter extenſion, which is ſtill, we believe, the method generally employed by ſurgeons to ſet a diſlocated limb in the human body, we ſhall moſt certainly be diſappointed. But if, inſtead of this vain attempt, we place the limb in ſuch a ſituation as that the power of thoſe muſcles which are the antagoniſts of the muſcles that keep the limb in its diſlocated place, may be fairly exerted, there will probably be little difficulty in replacing the bone in its ſocket, as the very ſtrength of the muſcles will aſſiſt us in the operation.

364 3. Lameneſs is very commonly the effect of tumours of the mucous bags or capſules, or of excreſcences formed on the bones of the legs and feet, or on the hoof.

In moſt of the joints there are appendages or membranous bags, called *burſæ mucoſæ*, or mucous bags, that are filled with a mucous fluid ſecreted into their cavities, for the purpoſe of aſſiſting the motions of the muſcles and tendons near the joint. It often happens that theſe mucous capſules are enlarged, either from hard work, which is a very common cauſe of their enlargement, or from ſome injury done to the neighbouring parts. When the enlargement is but ſmall, it is of little conſequence, but when the bags become unuſually diſtended, their ſize impedes the motion of the joints. Theſe tumours have received different names among grooms and farriers, according to the place where they are ſeated.

365 Wind-galls. When the mucous bags that are ſituated near the paſterns become enlarged, the tumours are called *wind-galls*.

366 Eog-ſpavin. When the enlargement takes place in the mucous bags on the inner ſide of the hock, the diſeaſe is called *bog-ſpavin*.

367 Thorough-pin. When the tumours are ſeated in the upper and back part of the hock, between the gemelli muſcle and the tendons of the great flexor muſcle of the foot, the affection is called *thorough-pin*.

368 Capulet. When the ſwelling is ſituated at that part where the tendon of the gemelli muſcles is inſerted into the point of the hock, it is called *capulet* or *capped hock*.

Of all the various ſwellings, the wind-galls are the moſt likely to produce lameneſs, and next to them the bog-ſpavin. The capulet and thorough-pin are ſeldom

369 of much conſequence.

Treatment. In the treatment of wind-galls and ſimilar tumours, the object is to remove the unuſual ſwelling, and to prevent its return. The ſwelling can be removed only by evacuating the contents of the tumour, or by promoting its abſorption. The former was recommended by Dr Bracken, and appears to have been ſucceſsful in a few caſes. The tumour is opened with a ſharp knife; and when the fluid has been evacuated, an eſcharotic ſubſtance compoſed of burnt alum, white vitriol, and red precipitate, is applied to the wound, to produce ſuch a degree of inflammation as may contract its cavity. Probably firing would have a better effect. Mr Coleman and the *cléves* of the veterinaty college, are much averſe to this operation, and certainlywhere it can be avoided it is not deſirable. Abſorption of the accumulated fluid may often be produced by the application of bliſters, and other ſtimulating applications; but this is moſt certainly effected by producing preſſure on the tumour, by means of a bandage applied round the part, with a boliſter or compreſs immediately over the ſwelling. When the unuſual enlargement has been reduced, its return is beſt prevented by firing the ſkin, ſo as to produce a conſiderable degree of conſtriction. Diſeaſes.

372 Splents. Horſes are ſubject to various excreſcences on the bones, or *exoſtoſes*, as they are called, which, when they form near the joints, or below the tendons of the muſcles, generally produce lameneſs. Theſe excreſcences have received various names, according to their ſituation. When they are formed about ſome part of the knee or canon bone, they are generally called ſplents, though farriers often call the excreſcences at the knee *offcletes*; and when there are two ſmall bony enlargements near each other, they are called *fuzes*. The excreſcences at the knee are not very common, and when they occur, are generally the effect of a wound; but ſplents about the canon bone are very common, eſpecially among young horſes, owing to the blood-veſſels in them being larger in proportion to the abſorbents than in old horſes; and hence the depoſition of bony matter may, in certain caſes of injury, be greater than what the abſorbents are able to take up again. Theſe excreſcences are eaſily produced in young horſes, by any blow or other injury that is capable of producing conſiderable inflammation; as ſtriking part of the canon bone which is the uſual ſeat of ſplents in what is called the *ſpeedy cut*, or by producing unuſual preſſure on one ſide more than on the other. Although a ſplent may not be in the neighbourhood of any material tendon, it may ſtill produce lameneſs by the pain which it excites; but when it interferes with a tendon, or ſome important ligament, lameneſs muſt in general be the conſequence.

371 Bone-ſpavin. When an excreſcence appears on any of the bones that enter into the formation of the hough, it is called a *bone-ſpavin*. It is moſt frequently found on the upper and inner part of the ſmall metacarpal bone, or on ſome of the wedge-like bones on the inſide of the hock. In the former ſituation it is often produced in conſequence of the outer heel having been raiſed by calkins; and in what are called cat, cow, or ſickle hammed horſes, it is often brought on by their natural deformity, though in theſe latter caſes the excreſcence is moſt commonly formed on the inſide of the hock.

372 Curb. An excreſcence ſituated on the back part of the hock towards its point, is called a *curb*. This is ſometimes formed on the bone, but it is frequently only an unuſual hardneſs and ſwelling of ſome of the ligaments.

373 Ring-bone. When an exoſtoſis forms on the leſſer paſtern bone, producing a hard ſwelling round the coronet, it is called a *ring-bone*. A depoſition of bone over the lateral cartilages is ſometimes alſo called by the ſame name.

374 Treatment. The treatment of all theſe excreſcences is much the ſame, and our object muſt be, either to excite the abſorbent veſſels to increaſed action, ſo as to remove the bony excreſcence, or to take this away by means of an operation. The former of theſe is not likely to be ſucceſsful,

Diſeaſes. ceſsful, except in the early ſtage of the complaint, when the bony matter is not completely hardened. If the excreſcence be diſcovered in time, bliſters are to be applied over the part, and repeated frequently, and ſtrong mercurial ointment, or an ointment compoſed of corroſive ſublimate and bliſtering ointment, is to be applied over the part, and gentle friction ſhould be frequently employed on thoſe parts of the limb that are above and below the ſwelling. By theſe means the excreſcences may ſometimes be removed; but when they have become too hard, theſe ſtimulating applications will ſcarcely excite the abſorbents to ſufficient action. The only method to which we can then have recourſe is an operation long ago practiſed by the old farriers, apparently with conſiderable ſucceſs. The bony excreſcence is laid bare, by making an inciſion through the integuments, and then the excreſcence is cut off by means of a ſharp chiſſel ſtruck by a mallet. After this the ſkin is to be laid down over the part, and we are to endeavour to heal the wound as ſoon as poſſible, by ſticking plaſter and a proper bandage. Firing is much employed by the French for the removal of ring-bones and other excreſcences. Mr Lawrence recommends that in firing a ring-bone, the inſtrument employed ſhould be thinner than uſual, and that the lines deſcribed ſhould not be more than one-fourth of an inch diſtant from each other, being croſſed obliquely like a chain.

375 Corns. Sometimes an inflammation takes place on the lower part of the hoof, between the ſenſible and horny ſoles, or between the outer cruſt and the binders, producing a ſlight effuſion of blood, and leaving a conſiderable tenderneſs in the part. When the hoof is examined, after being perfectly cleaned, there is commonly ſeen a diſcoloured ſpot, ſometimes red, but more uſually blue, or blackiſh, like what is ſeen below one's nail, when the finger is jammed. The affection is commonly called by farriers a *corn*. (In Scotland, we believe it is called a *ſtone-creſs*), though it is by no means ſimilar to a corn in the human foot. Horny excreſcences which might properly be called *corns*, are ſometimes however produced on the horſe's hoof; and of this nature, we ſuppoſe, were the *corns on the feet of Cæſar's horſe*.

This complaint is always owing to an improper preſſure on the horny ſole, by which the ſenſible ſole is ſqueezed between it and the coffin bone. Hence a quantity of blood is effuſed from the veſſels of the ſenſible ſole, which, if it remains for any length of time, produces an unuſual tenderneſs in that part of the hoof. Corns are generally produced by ſhoes that are too hollow next the hoof, ſo as to allow a ſtone to get between the ſhoe and the ſole, and thus preſs upon the latter; or it may be produced by the ſhoe being made too ſhort or too narrow, and thus indenting itſelf upon the ſole between the binders and the cruſt.

The beſt manner of treating a corn appears to be, to remove that part of the ſole which is immediately below the ſeat of the affection with a drawing knife, taking care not to cut farther than the ſeat of the effuſed blood; then to inſert a pledgit dipped in tincture of myrrh, into the opening. No preſſure muſt be applied upon the part, and a piece of the ſhoe oppoſite the corn ſhould be cut out, to prevent preſſure from taking place. The horſe muſt be allowed to ſtand quiet, on a level ſurface, and muſt not be worked till the horny part of the ſole that has been cut away ſhall be renewed; and even then it would be proper to turn him to graſs for ſome time, without ſhoes, or with very ſmall tips of iron at the toes. Diſeaſes.

4. Lameneſs may be produced by many injuries of the feet, brought on by hard work, bad ſhoeing, or other ill treatment. 376

When horſes are ridden hard on pavement, or hard dry roads, eſpecially if the frog has been pared down, or even the cruſt cut away too much in ſhoeing, the battering produced on the hoof frequently brings on an inflammation of the ſenſible part within. This may happen alſo to cart horſes made to draw heavy loads, under ſimilar circumſtances.

377 Grogginess. When the horſe's hoof is not very delicate or tender, this battering ſometimes only produces a ſtiffneſs, or ſwelling of the legs, and contraction of the ſinews. This ſtate is commonly called *groggineſs*, or a horſe that has his feet thus battered, is ſaid to be *groggy*.

378 Founder. If inflammation is excited within the hoof, a moſt painful ſpecies of lameneſs is produced commonly called *founder*, or the horſe thus lamed is ſaid to be *foundered*. The complaint is alſo called *foot-founder*, to diſtinguiſh it from a diſeaſe which we ſhall deſcribe hereafter, and to which farriers ſometimes give the name of *body-founder*. This inflammation may take place in any of the feet, or in all; but it is moſt commonly produced in the fore-feet: and as, from the pain which the horſe experiences, he endeavours to throw as much as poſſible of his weight, upon his hind-feet, and appears unable to ſupport himſelf on his fore-feet, he is ſaid to be *down before*.

This complaint moſt commonly takes place in horſes; but it may take place in cattle or ſheep, brought on by hard driving, on hard ſtony roads, when ſent to fairs, or markets. In theſe animals, however, the complaint ſeldom proceeds to ſuch a height as in horſes; and it is in them more eaſily relieved.

379 Symptoms. The ſymptoms of *founder* are thus deſcribed by Mr Feron. "Foundered horſes have a general ſtiffneſs of the fore-hand, attended with a conſiderable acute pain of the joints, ligaments, and muſcles, connected with it. The pain which the animal ſuffers on moving the joints, obliges him to keep the flexor muſcles in a conſtant relaxed ſtate, which poſition ultimately produces an entire debility and ſtiffneſs of every joint which compoſes the fore extremity of the animal. If the horſe has been neglected, or the diſeaſe ſo rapid in its progreſs that it cannot be removed, the ſymptoms will increaſe ſo rapidly, that in a very little time we may obſerve the cuticular veins become turgid and varicoſe, ſimilar to the lymphatic enlargement in farcy. In this ſtate, exerciſe conſiderably increaſes the pain and violence of the ſymptoms, the animal falls off his food, his health becomes very much impaired, and a general decay of the whole limbs, particularly obſervable in the extenſor muſcles of the fore-arm, ſoon renders the animal uſeleſs for activity *." * *Feron's Farriery*, p. 120.

When the complaint affects the fore-feet, the horſe throws his hind-feet as far forward as poſſible, which leads thoſe who do not underſtand the nature of the complaint to ſuppoſe that the horſe is affected with a weakneſs in his loins. When it is ſeated in the hind-feet the horſe throws his body forwards, in order to relieve

Diſeaſes. lieve the hind-feet of their weight. In this caſe the horſe is ſuppoſed to labour under an affection of the cheſt, which has been called *cheſt-founder*.

The complaint uſually comes on very rapidly, and ſometimes appears a few hours after hard riding, or after the application of other cauſes, that will immediately be mentioned.

It may be eaſily known that a horſe is foundered, as he can ſcarcely walk on firſt coming out of the ſtable, and evidently labours under great pain. Like many other affections that produce lameneſs, the horſe appears to be relieved by exerciſe, but this relief is only temporary; and exerciſe only tends to increaſe the diſeaſe.

Mr Feron ſays, that, on diſſecting the feet of foundered horſes, he has frequently found the membranes of the joints thicker than in their natural ſtate, and ſometimes a diſpoſition to *anchyloſis*, or ſtiff joint; which in ſome of the joints was evidently obſerved.

380 Cauſes. The *founder* is very commonly produced by battering the hoofs on hard ground. It may be brought on by any cauſes, that are capable of exciting inflammation in the internal ſenſible parts of the foot. It is frequently produced by waſhing the legs of a horſe, while ſweating; and according to Mr Feron this is ſo evident, that if we obſerve the horſes belonging to public coaches, in whom this practice is very common, we ſhall ſee that ſixteen out of twenty labour under the torture of this diſeaſe. Founder may alſo proceed from allowing the horſe, while ſweating and fatigued, to ſtand long in a cold, damp air.

381 Treatment. In the treatment of founder, the great object is to remove the inflammation, which is beſt done by bleeding in the veins of the foot, and the application of bliſters about the joints. The ſhoe of the affected foot muſt be removed, and the toe of the cruſt may then be pared to the quick, in order to produce a diſcharge of blood from the veſſels of the affected part. It will be proper to pare the whole of the cruſt as thin as poſſible, eſpecially at the heels and quarters, in order to allow the frog to come in contact with the ground. Bliſters are now to be applied round the fetlock, down to the foot. Mr Feron recommends immerſing the feet in warm water 24 hours after bliſtering, keeping them there all day, and applying a large warm poultice of bran and water at night. Mr Blaine, on the other hand, adviſes the uſe of cold aſtringent lotions, as Goulard or ſal ammoniac in vinegar. Sometimes the pain in the feet is ſo violent, that the horſe can ſcarcely bear to ſupport himſelf upon them, and indeed if he could remain quiet, it would be better to let him lie down. But if he proves reſtleſs, he may be partly ſupported by means of a ſheet drawn round him, with its corners pulled up to the cieling of the ſtable by pulleys, ſo as to let the horſe's feet juſt touch the ground.

The horſe muſt be kept rather low, and if the inflammation is very great, or if there is any fever, it will be proper to adminiſter cooling remedies, ſuch as the drenches marked 22 and 25 in the receipts. The belly muſt be kept moderately open, and all exerciſe muſt be avoided.

Sometimes after the inflammation has ſubſided, the lameneſs ſtill continues. This may be owing to the formation of horny matter between the ſenſible and horny ſole. Mr Blaine recommends that this be removed by cutting away the horny ſole; but we much doubt whether this operation would be attended with the deſired effect. Diſeaſes.

382 Stubbed feet in dogs. *Founder*, properly ſo called, can take place only in thoſe animals that have horny hoofs; but a ſimilar affection not unfrequently occurs in the feet of hounds, after a long and fatiguing chaſe. It conſiſts in an inflamed ſtate of the feet, produced by long running, eſpecially over hard or ſtony ground. When the dogs come home their feet are hurt and ſwelled, inflamed, and ſometimes cracked or chopt. The dog evidently feels conſiderable pain, and if he lies down for a little, he can ſcarcely be made to riſe again. Dogs in this ſtate are ſaid to be ſtubbed in the feet, and are often ſo much lamed, that they cannot be taken out again for ſome days.

When the inflammation is but ſlight, it requires but little attention, as the dog will himſelf allay the ſwelling and pain, by conſtant licking. When, however, the feet have been much bruiſed, the cracks pour out a bloody or purulent matter, and the caſe requires greater attention. The feet ſhould firſt be bathed with warm water, and great care taken that no dirt or gravel be ſuffered to remain between the claws or in the cracks. After bathing, the feet may be rubbed with ſome digeſtive ointment, and a cold poultice compoſed of crumbs of bread well moiſtened with vinegar and water, ſhould be tied round the affected foot.

383 Contracted feet. The hoof of the horſe frequently becomes lengthened, and contracted at the heels and quarters. This unnatural ſhape is commonly the effect of bad ſhoeing, by which the frog is deprived of the neceſſary preſſure on the ground, and thus the heels are prevented from expanding, while the nails that are fixed in the quarters contribute to prevent expanſion there, and thus the hoof is unnaturally lengthened at the toe. This contraction is conſiderably increaſed by the heat of ordinary ſtables, and by the evaporation that takes place from the hoof while the horſe ſtands within doors, on account of the vacancy left below the frog, while the heels are elevated above the ground. Contraction of the hoof cauſes lameneſs, by producing an unnatural degree of preſſure on the ſenſible parts within, eſpecially on the ſenſible frog, which is not unfrequently inflamed in theſe caſes.

The remedy for this defect is, to bring the frog gradually to preſs upon the ground, by lowering the heels; but as, in the very ſenſible ſtate to which the feet are commonly brought by contraction, it might be dangerous to apply preſſure to the frog at once, it is adviſable to lower the heels gradually, in the manner directed in N° 146. If the frog is much diſeaſed, as ſometimes happens, a bar ſhoe ſhould be employed, by which means ſlight preſſure may be made by fixing an iron plate from the heels of the ſhoe towards the toe. The beſt means of producing preſſure in theſe caſes would probably be to employ Mr Coleman's artificial frog. The upper part of the hoof ſhould be raſped thin, eſpecially at the quarters, as theſe parts of the hoof will then be more eaſily expanded by the motion of the lateral cartilages. The lower part of the hoof ſhould alſo be kept moiſt, eſpecially the frog.

Mr Blaine remarks, that dark-cheſnut horſes are more ſubject to contracted feet than others, and he relates a caſe of a mare belonging to himſelf, who had all her feet contracted. Theſe he endeavoured to expand

Diſeaſes. by means of jointed ſhoes, furniſhed with a ſliding bar, which was kept in its ſituation by means of pegs, ſo that in this way the heels of the ſhoe might be gradually widened, by moving the croſs bar farther on towards the toe. This method is very ingenious, but Mr Blaine acknowledges that it did not fully anſwer his purpoſe.

When the heels have been gradually lowered ſo far, that the frog can bear the proper preſſure, the horſe ſhould continue to wear a thin-heeled ſhoe; but if he is not required to be worked, it would be better to ſend him out to graſs without ſhoes, where the paſture is not too dry.

384 Running thruſh. It often happens in caſes of contracted feet, and in ſome other caſes, when the frog does not receive the due degree of preſſure, that a running takes place from the cleft of the horny frog, occaſioned by a degree of inflammation which is followed by a ſecretion of purulent matter. This complaint is commonly called a running thruſh. While it extends no farther than the horny frog, it is ſeldom attended with any ſerious conſequences; but if it be neglected, the matter extends through the horny to the ſenſible frog and ſenſible ſole, and produces canker or quittor.

Some horſes have naturally a running from the cleft of the frog; and ſo long as this is ſlight, and the parts are kept clean, it is of little conſequence. We know there are ſome perſons who conceive a *ſlight running thruſh*, as rather beneficial to a horſe, and do not eſteem it as a mark of unſoundneſs; but we cannot agree with theſe gentlemen in either particular, as, though the complaint does not in itſelf abſolutely render a horſe lame, ſo long as his feet are properly attended to, it will, if neglected, degenerate into a foul ulcer, the matter of which may eaſily penetrate into the internal parts of the foot. A *running thruſh* is very commonly the conſequence of bad grooming, and ſuffering dirt and gravel to lodge in the clefts of the frog, and it is ſtill more frequently produced in the common method of ſhoeing, by cutting and paring away the frog.

In the treatment of a running thruſh, the principal objects are, to remove the cauſe that firſt produced it, and to ſtop the diſcharge of purulent matter. The latter is eaſily effected by applying to the part ſome ſtimulating liniment. Mr Blaine recommends for this purpoſe a compoſition of two ounces of tar, with ſix drachms of vitriolic acid, which is to be applied hot every day, by pouring it into the cleft of the frog from a ſpoon. The diſcharge, though eaſily ſtopped in this way, will ſoon return, unleſs the proper degree of preſſure be given to the frog; and this is to be brought about by proper attention to ſhoeing the horſe with thin-heeled ſhoes, taking care that the heels be lowered gradually, and ſlight artificial preſſure be made on the frog, till it is become ſufficiently healthy to bear the natural preſſure of the ground.

385 Canker. When the matter of a running thruſh inſinuates itſelf upwards to the ſenſible parts of the foot, it forms what is called *canker*, in which there is a conſiderable inflammation, producing a luxuriant unhealthy fungus, ſpringing up from all the diſeaſed ſurface that is expoſed, and producing a great degree of tenderneſs, and what may be called a rottenneſs of the hoof. If this diſeaſe continues for any conſiderable time, it attacks the whole ſubſtance of the foot, extending to the tendons, ligaments, and bones, till at laſt the foot may abſolutely drop off with diſeaſe. Mr Coleman conſiders canker as generally the effect of too much moiſture applied to the foot or hoof. Diſeaſes.

To check the progreſs of a canker, the whole of the excreſcence that appears on the external part of the hoof, is to be cut away cloſe to the ſurface from which it ſprings, and ſuch parts of the horny ſole as appear to be detached from the ſenſible ſole, ſhould be removed, to prevent the matter from lodging in the internal parts. When the diſeaſed part is fairly expoſed to view, it is to be waſhed with a ſolution of ſome metallic cauſtic, ſuch as nitrate of mercury, N° 49 of the receipts, or a ſolution of lunar cauſtic, in the proportion of a drachm to two ounces of ſoft water. This is beſt applied by moiſtening a pledget of lint or tow, and confining this upon the cankered ſurface, by applying a regular preſſure by means of croſs bars of iron introduced beneath the ſhoe. A continuance of theſe applications, while the frog is gradually expoſed to preſſure, will in general ſoon ſtop the progreſs of the diſeaſe, and when this is removed, the horny parts of the hoof that had been cut away will be gradually removed; and by ſhoeing the horſe properly afterwards, the diſeaſe will be prevented from returning.

Cattle and ſheep are ſubject to a diſeaſe very ſimilar to canker in the horſe, producing a diſcharge of fetid matter from between the claws of the hoof, or ſometimes from only one claw.

386 Fouls. This affection in cattle is commonly called *the fouls*, or the cattle are ſaid to be *foul in the foot*. Managers of cattle commonly divide this diſeaſe into two kinds, the ſoft, and the horny, which are ſaid to require different modes of treatment. In the *ſoft fouls*, a running of very offenſive matter takes place from the heels, or between the claws of the hoof; and the animal appears exceedingly lame. The treatment in this caſe conſiſts in cutting away all the ſoft and ſpongy parts, and then applying a cauſtic liquid, ſuch as will preſently be deſcribed, for the foot-rot in ſheep. The parts are then to be covered with a pledget ſpread with mild ointment, or, what is very common among farmers, a piece of fat bacon may be wrapt round the part, tied on the foot, and ſuffered to remain for two or three days. In the mean time the animal ſhould ſtand very clean, and be allowed to reſt as much as poſſible.

The *horny fouls* ſeem to be very analogous to corns in horſes. The animal is very lame, and, on examining the foot, the hoof feels very hot, and, when hard preſſed, the beaſt evidently feels much pain. There will commonly be found ſome part of the horn penetrating into the ſofter parts of the foot, either at the heel, or between the hoofs. In the treatment it is neceſſary to cut away theſe parts of the horn, as well as any part under which there appears much inflammation. For this purpoſe, it will probably be neceſſary to caſt the animal, but care ſhould be taken that he be thrown on a ſoft place. After the hoof has been pared away, a rag moiſtened with vinegar and water ſhould be tied on, and the animal muſt be ſent to graſs in a ſoft ſmooth paſture. If the inflammation and pain are very great, it may be neceſſary to bleed from the veins of the foot.

387 Foot-rot in ſheep. In ſheep it is called the foot-root, and is generally produced by their being kept on a wet ſoil. It is remarkable that ſalt marſhes do not produce it. According

Diſeaſes. to Mr Lawrence, frequent travelling to and from the fold, or by ſuckling ewes from the hot dung of a ſheep-houſe, will occaſion it. Some are of opinion, that it originates from the ſame cauſe which occaſions chilblains in the human feet; and this opinion is maintained in the eſſay on the diſeaſes of ſheep, affixed to Mr Findlater's Survey of Peebles, where it is ſtated, that the remote cauſe of the diſeaſe is weakneſs, and the immediate cauſe cauſe cold and wet, as ſtanding in cold weather upon wet paſtures, with the feet conſtantly ſoaked in water. Dr Wilkinſon of Enfield conſiders moiſture as the prediſpoſing cauſe, and has found the diſeaſe to be produced from the ſheep continuing in long graſs during a mild winter. The ſame cauſe generally, although perhaps gradually, operates upon the whole flock, and then it has been ſuppoſed that the diſeaſe is contagious. The late Lord Somerville had a piece of paſture which always produced the foot-rot on any ſheep that were put into it; but the diſeaſe was entirely prevented or rooted out by a careful ſelection of the ſheep in order, by paring the hoofs of thoſe that began to be affected, and by the uſe of cauſtics not too corroſive. Theſe appeared to be the moſt proper means of ſtopping the complaint, and the beſt cauſtic application is ſaid to the nitrate of mercury. It is evident, that, during the application, the hoofs of the ſheep ſhould be kept as clean as poſſible. Whether its greater or leſs prevalence depends on the leſs or greater attention paid to the ſheep, is not perhaps fully aſcertained. It is, however, certain that the ſheep of ſome diſtricts are entirely free from it. We are informed, that in Tweeddale the complaint is ſcarcely known.

388 Pummiced feet. There is a diſeaſe in the horſe's foot, in which the coffin-bone is forced backwards, and made to preſs unnaturally upon the heels, by which its edges being ſubjected to unuſual preſſure, become partly abſorbed. Hence this bone loſing its ſupport, becomes preſſed in its concave part, where inflammation is produced, and bony matter is thrown out, rendering the lower part of the coffin-bone convex inſtead of concave, and the ſole is rendered unuſually thin. This diſeaſe is called *pummiced feet*, and may be brought on in three ways; from improper ſhoeing, from inflammation, as in caſe of founders, and from a natural defect in the foot itſelf. It is ſaid to be very common in wet ſoils. It is very commonly produced by applying the ſhoe red-hot to the horſe's foot. Its immediate cauſe appears to be an inflammation of the ſenſible lamina, by which a quantity of coagulated lymph or of bony matter is thrown out, that forces back the coffin-bone in the manner above deſcribed. When the diſeaſe is completely formed, it does not appear capable of being radically cured, but only admits of palliation. Mr Blaine recommends, that the growth of the ſole ſhould be encouraged by every means, but the foot ſhould not be kept improperly moiſt. The beſt means would be, the turning the horſe out without ſhoes in a dry paſture. No part of the heels or ſole ſhould be removed in this caſe, as the parts are already too ſlight. A ſhoe ſhould be formed, if poſſible, that preſents a hollow ſurface to the foot, and a plain one to the ground. This may be done, by making it of rather an increaſed thickneſs, which will admit of its being hollowed within, and bevilled from the outer to the inner edge of the web.

389 Sandcracks. Sometimes perpendicular fiſſures or cracks are ſeen in the hoof extending between the fibres in a parallel direction from above downwards. Theſe are called ſand-cracks, and generally take place near the quarter, more frequently on the outer than the inner ſide, and oftener in the fore than the hind foot. Theſe cracks ſometimes come on ſuddenly, and then generally denote a contraction of the hoof. They are alſo ſaid to have ariſen from a wound in the veſſel or part of the coronary ligament, bringing on a ſecretion of horny matter, which gets between the fibres of the hoof, and cauſes them to ſeparate. Diſeaſes.

The means of preventing the crack from extending, are to thin the hoof where the crack has taken place as much as poſſible, and to make a tranſverſe ſection a little way acroſs at the upper part. If the crack ſhould ſtill continue to gape, it muſt be carefully covered, and the hoof bound round, ſo as to cloſe it as much as may be, and the portion of the cruſt that reſts on the ſhoe ſhould be chambered away a little, by which means the divided parts will be more likely to come together.

390 False quarter. When a wound has been inflicted on the coronet, the coronary ligament commonly becomes injured, and its vaſcular part does not ſecrete ſo much bony matter as uſual. Hence there is a ſpace left between the old horny matter of the hoof, and the new that is formed from other parts; and this produces what is commonly called a *falſe quarter*. A falſe quarter may alſo be produced, in conſequence of a quittor extending upwards through the coronet. As the ſenſible lamina within the hoof are liable to be preſſed in this vacant ſpace between the horny edges, thus cauſing violent pain, the falſe quarter is attended with a lameneſs of the worſt kind; for as this interference of the lamina ſometimes takes place ſuddenly, while the animal is in motion, the pain makes him ſhrink, and he not unfrequently comes down.

The only way of remedying this defect is, to excite ſuch an action in the coronary ligament as may diſpoſe it to throw out new horny matter, and thus fill up the vacant ſpace. This is beſt effected by removing the ſurrounding horn, and applying bliſters to the coronet, while the part of the hoof that is oppoſed to the ſhoe ſhould be hollowed away as much as poſſible, to admit of the ſeparated parts approaching each other.

391 Cutting. When a horſe in motion, eſpecially in trotting, brings one foot ſo near another as to interfere, and thereby graze or wound one of the feet, he is ſaid to cut. Sometimes the feet of a horſe are in this way ſeverely wounded, and temporary lameneſs is produced. In cutting, the horſe may either wound the heels of the fore feet, with the toe, or ſide of the hind ſhoe, which is the moſt common caſe; or he may wound the fore part of the hind-foot, juſt above the hoof, by ſtriking it againſt the heel of the fore ſhoe; or, laſtly, he may bring two of the feet ſo cloſely together, as to wound the inner ſide of either.

Cutting may ariſe from a bad habit, or from a natural deformity of the feet, but it is very commonly the conſequence of bad ſhoeing. When horſes cut from turning out their toes, which is by much the moſt common cauſe, they are obſerved to have the inner quarter of the hoof lower than the outer, and the fetlock joints are thus nearer each other than thoſe of horſes which have their limbs ſtraight. Theſe facts led farriers to a concluſion, that if the inner quarters were raiſed to a level with the outer, and eſpecially if made

even

Diſeaſes. even higher, the fetlock joints would be thrown further apart, ſo that the foot would paſs the ſupporting leg without ſtriking: Accordingly, it has been uſual to make the inner quarter of the ſhoe higher than the outer, and this has been the common practice for a long time. Mr Morecroft, by making trial of a ſhoe, of a ſhape the reverſe of what we have deſcribed, namely, having the outer quarter thick, and the inner thin, completely prevented cutting in the horſe, on whom thoſe ſhoes were tried, and the utility of the improvement has been confirmed by ſucceeding trials. According to Mr Blaine, the principle on which this is ſuppoſed to act is, that when a horſe is at reſt, he ſupports his weight equally on both feet; but, having his inner quarter much raiſed, in the common mode of attempting to remedy the defect of cutting, when one foot is elevated he muſt be ſupported obliquely on the other, and hence have a tendency to fall outwards; to prevent which he brings the moving foot nearer the ſupporting one, by which he ſtrikes it. Conſidering it in this point of view, it is not difficult to account for our author's mode of reaſoning on his method, which, by elevating the outer inſtead of the inner ſide of the ſupporting foot, muſt neceſſarily give it a diſpoſition to lean inwards, and fall to the inſide, which will throw the moving further from the ſupporting foot. But, ingenious as this mode of reaſoning may be, it is to be feared, that by thus throwing an increaſe of weight on the inner ſide, we ſhall ſometimes be in danger of producing evils, that will counterbalance the prevention of cutting *.

* *Blaine's Outlines*, vol. ii.

392 Lameneſs may be produced by any one of the cauſes that we have mentioned, but it may happen that a combination of two or more of theſe cauſes takes place at the ſame time in different parts of the ſame limb: thus the foot may be pricked with a nail, and a ſtrain may take place, nearly at the ſame time, in the ſinews of the leg, or the ligaments of the joints; for the pain excited by the nail firſt makes the horſe trip or ſtumble, and then, his making a ſudden exertion to ſave himſelf, or eaſe the pained foot, a ſtrain of the ligaments or ſinews frequently takes place. A ſimilar complication is often produced in a horſe that is affected with ſpavin, or other bony exceſcences, as his exertion to ſave the limb that feels painful from the rubbing of the muſcles or tendons againſt the ſpavin, may produce a ſevere ſtrain in the muſcles of the ſhoulder.

As the cauſes of lameneſs are ſo various, and the real ſeat of it frequently very obſcure, a practitioner ſhould be extremely cautious how he gives a deciſive opinion with reſpect to either, before he has well examined the parts where lameneſs may take place, and enquired into every circumſtance that may aſſiſt him in forming his opinion. For want of ſuch precaution, and from a ſuperficial examination of the part that is ſuppoſed to be the ſeat of the affection, egregious blunders and dangerous miſtakes are not unfrequently committed, and applications have been made to parts that are really ſound, when it is afterwards diſcovered, to the confuſion of the practitioner, that the real cauſe of the lameneſs was in a different place. Nothing is more common than for ordinary farriers to apply their liniments and embrocations to the ſhoulder, when in fact the affection that cauſes the lameneſs is ſeated in the feet.

As, perhaps, in nine caſes out of ten, the foot is the part that has received the injury, this ſhould firſt be examined with the ſtricteſt attention, the hoof ſhould be made perfectly clean, eſpecially in its under ſurface, to ſee whether there be any crack or fiſſure, any diſcoloration, any particular heat, &c. The paſtern and all round the coronet ſhould be alſo carefully inſpected; and, if nothing is found, the examination ſhould be repeated next day, or even a third time. The foot is more particularly to be ſuſpected of being the ſeat of the complaint, when the lameneſs makes its appearance ſoon after the horſe has been ſhod, or has had his ſhoes faſtened; as the foot may be lamed by a nail in ſhoeing, though the point of the nail has not penetrated to the quick. The nail may be ſo thick, or may paſs ſo near the quick, as to preſs in a ſmall part of the hoof upon the ſoft parts, thus producing exquiſite pain, and perhaps inflammation. It is therefore proper always to remove the ſhoe from the foot of the affected limb, and if the cauſe of lameneſs is not very evident to wait a few days, to ſee whether the removal of the ſhoe has produced any alteration for the better.

Diſeaſes.

No certain rule can be laid down for judging of the ſeat of lameneſs from the motion of the affected limb, though this is conſidered by ſome as one of the ſureſt marks. The deranged motion in one part of the limb very commonly ariſes from ſympathy with another part that is the real ſeat of the affection.

393 We have now, we believe, mentioned all the important cauſes of lameneſs, except the *ſtring-halt*, or *click-ſpavin*. This is an affection of the hind quarters, producing a ſudden jerking of the legs upwards, when the horſe attempts to move. It appears to be a nervous affection, and ſeems to be ſomewhat analogous to the *chorea*, or *St Vitus's dance*, in children. We do not know that this affection has ever been cured, but it is ſaid that it may be palliated by allowing the horſe to run much at large, and letting him remain untied in a large ſtable. Mr Lawrence recommends that, after a hard day's work, both hind legs be immerſed in a warm bath up to the hocks, and kept there as long as the water continues warm, when they are to be rubbed perfectly dry, and the ſame bath and rubbing repeated in the morning. He alſo adviſes anointing the back ſinews, and about the hocks, with ſtrong camphorated ointment.

St.ing-halt.

394 We have occaſionally, in this and the preceding chapters, ſpoken of abſceſſes and ulcers, and their treatment; and we can add little here on that ſubject, as it will be fully treated of in the article SURGERY; and the inſtructions to be there laid down will apply nearly as properly to the inferior animals as to man. We may juſt remark, that foul ulcers, and ſuch as do not heal kindly, are perhaps more common in ſome of the inferior animals than in man; and hence they require in the former applications of a more ſtimulating nature, to excite a proper degree of healthy action in the ulcerated part. There are a few particular ulcers which call for conſideration in this article, and we cannot, perhaps, treat of them in any part of the treatiſe more properly than under the morbid affections of motion.

Ulcers.

395 There ſometimes takes place an inflammation, and conſequent ſuppuration in the mucous capſules, at the articulation of the head with the firſt vertebra of the neck, near the inſertion of the cervical ligament. This affection is commonly called the *poll-evil*. It is almoſt

Poll-evil.

Diſeaſes. always the conſequence of an injury done to the back of the head, by a horſe's hanging back in his collar, by ſtriking his head againſt the rack or manger; and is very frequently produced by a blow given on the head by brutal coachmen or carters. An ulcer in this part is often very difficult to heal, and when it extends beyond the ſkin, the matter ſometimes inſinuates itſelf below the ligament of the neck, and on each ſide of it, and it not unfrequently produces a caries or rottenneſs of the vertebræ. The cure of the poll-evil is moſt eaſily effected when the inflammation is firſt diſcovered, before a ſuppuration takes place; as, when once matter is formed, it commonly produces ſinuſes in the looſe cellular ſubſtance about that part of the head, and theſe are not eaſily healed. When, therefore, we have reaſon to ſuppoſe that inflammation has begun in the ſkin of this part of the neck, every means muſt be employed to prevent its progreſs towards ſuppuration. A bliſter ſhould be immediately applied over the part, and when this has done its duty, a ſolution of ſal ammoniac in vinegar, or vinegar and water, ſhould be applied by means of a cloth kept conſtantly wet. If a ſuppuration appears inevitable, it muſt be encouraged by fomenting the part frequently with warm water, or by the repeated application of warm poultices; and when the ſwelling appears ſufficiently ripe, it muſt be opened, which is beſt done by introducing a ſeton from the higheſt to the moſt depending part of the tumour, as directed in No. 173. The cord of the ſeton muſt be examined every day, wiped dry, and rubbed with a little digeſtive ointment, and the ſore ſhould be carefully excluded from the air.

If the ſuppuration has proceeded any length, before it is diſcovered, there will probably be a number of ſinuſes, or *pipes*, as they are called, with matter lodging in each. If it can be eaſily effected, it would be proper to lay theſe open, and make them communicate with each other, or, if their direction can be aſcertained, a ſeton may be paſſed through each. When a proper opening has been made for the matter, and care taken that none of it lodges, the ſore will ſoon heal, by the application of the proper ſtimulating ointments.

It is ſometimes neceſſary to employ the knife in this caſe; but when this is done, the greateſt care ſhould be taken not to wound the ligament, or, as the farriers call it, the *fix-fax* of the neck. The beſt method of avoiding this is, to have the animal's head faſtened very high to the rack, by which the ligament will be more ſlack, and the finger can be eaſily introduced below it, ſo as to be a guide to the knife.

396 Fiſtulous withers. We mentioned in No. 341. the chafing of the back with the ſaddle. There is another injury of a ſimilar kind, that is often ſuffered by the withers, from the ſaddle being allowed to preſs on them too long. This preſſure and rubbing ſometimes produces an inflammatory ſwelling, which, if it be not ſoon diſcuſſed, goes on to ſuppuration, and produces a ſore which farriers call *fiſtulous withers*, or a *fiſtula in the withers*. This is alſo a very troubleſome ulcer, as the matter ſometimes penetrates below the ſhoulder, and makes its way down the bones of the fore leg; or, by inſinuating itſelf among the vertebræ of the back, renders them carious. The treatment in this caſe is much the ſame as in the laſt; the inflammation ſhould be diſcuſſed as ſoon as poſſible, and if matter forms, it ſhould be evacuated by means of ſetons. It is frequently required to paſs a ſeton through the tumour on each ſide of the withers, in order to produce a proper inclination of the orifice, to carry off the matter. When ſinuſes form, they muſt be opened, as in the caſe of poll-evil. Diſeaſes.

397 Canker of the ear in dogs. There is ſometimes a ſpecies of ill-diſpoſed ulcers in the external part of the ears of dogs, very difficult to heal. It is generally called *canker*. Theſe, when they heal, leave hardened edges, which frequently break out again in the courſe of a few months. The beſt application in this caſe is lunar cauſtic applied to the edges, to encourage them to ſlough off; but if this ſhould not be found ſufficient, the beſt remedy will be to ſear off the diſeaſed parts with a red-hot knife, or they may be cut off by a ſimple inciſion.

Chap. III. *Morbid Affections of Digeſtion.*

398 In order that the food may be well digeſted, when received into the ſtomach, it is neceſſary that it undergo the previous operation of chewing; unleſs it be of ſuch a nature, as to be eaſily ſoluble in the gaſtric juice, without this previous preparation. The latter is the caſe only with dogs, whoſe food conſiſting almoſt entirely of animal matter, requires little or no chewing. But the food of horſes, ſheep, and cattle in general, requires to be well chewed, either when firſt ſwallowed, or in ſheep and cattle by ſubſequent rumination.

399 Sore mouth. The mouth in theſe animals is ſometimes ſo ſwelled, or otherwiſe affected with ſores or cracks, that it is with difficulty the animals can chew their food. Sometimes there are bloody chinks or chops in the palate, occaſioned by thiſtles or other prickly plants, which are mixed with the hay, or grow up among the graſs. Theſe ſhould be waſhed on their firſt appearance with ſalt and vinegar, applied by means of a rag tied to a ſtick. If neglected, theſe chops frequently become inflamed and ulcerated. If pimples ariſe, they muſt be opened when they begin to ſuppurate, by means of a pointed cautery. There are ſometimes found within-ſide the lip of cart horſes and other ordinary cattle, ſoft tumours, or puſtules with black heads, which are called *giggs*, *bladders*, or ſlips in the mouth. They do not always occaſion much inconvenience, but ſometimes they grow to a large ſize, ſo as to grow troubleſome, and prevent chewing. When this is the caſe, they muſt be removed, either by faſtening a thread about their roots, as directed in the treatment of warts, where they are of ſuch a form as to admit of a ligature; or by the knife, applying afterwards the hot iron or cautery. In performing this operation, care muſt be taken to draw the tongue to one ſide, ſo that it may not be wounded. After removing theſe excreſcences with the knife and cautery, the mouth may be waſhed with a ſolution of white vitriol or alum. Excreſcences of a ſimilar kind, called *barbs* or *paps*, ſometimes grow below the tongue, and muſt be removed where practicable by means of ligature, as it is dangerous to employ the knife. When theſe excreſcences are neglected, there ſometimes ariſe in the mouth little ulcers with white ſpecks, very ſimilar to the aphthous cruſts that form in the human mouth. It is recommended by ſome writers to uſe the cautery on theſe occaſions; but probably a detergent lotion, ſuch as we have juſt recommended, will anſwer the purpoſe of removing them.

The

Diſeaſes.

400 Wounds in the mouth.

The mouth or tongue of horſes are ſometimes wounded with the bit or curb. When this happens, a lotion made with alum diſſolved in water, and ſweetened with honey, may be employed; and the bit ſhould not be uſed again till the mouth is healed.

401 Lampas.

Many veterinary writers have deſcribed the diſeaſe in the horſe's mouth called the *lampas*, which is ſtated to be an inflammation and ſwelling of the firſt bar of the mouth in a young horſe, ſo as to prevent his chewing. We believe that Laſoſſe and Dr Bracken were the firſt to deny the exiſtence of ſuch a complaint, which is now generally diſcredited among moſt of our modern writers. We have no doubt that ſuch a ſwelling may take place; but it can ſcarcely be attended with the ill conſequences commonly attributed to it, or require ſuch vigorous treatment as is uſually recommended.

402 Choaking.

It may happen, that any of theſe animals ſhall have a difficulty of ſwallowing, from various cauſes; either from an unuſual narrowneſs in the gullet, or from the morſel attempted to be ſwallowed being too large. The latter very frequently happens to cattle who are fed upon turnips or potatoes; and the choaking thus produced ſometimes proves very dangerous, as, if the obſtruction is not ſpeedily removed, the animal will die for want of breath. The method commonly employed among country farmers for *uncloaking* cattle, as they term it, is to thruſt down the throat a large ſtiff rope, ravelled at the end, and well greaſed. This often ſucceeds, but it is a clumſy method; and if the rope, by having been long uſed, or becoming dry, ſhould loſe its ſtiffneſs, it will be bent in endeavouring to force down the obſtruction; or, if the ravelled end be not pretty large, or the obſtructing morſel of an irregular ſhape, the rope may paſs between the ſide of the gullet and the obſtruction, without this being removed. Several intelligent farmers have therefore laid aſide the uſe of the rope, and have contrived an inſtrument ſimilar to the probang employed by ſurgeons. An inſtrument of this kind has been already mentioned, in the deſcription of Mr Hunter's feeding byre in N° 236. An account of one that appears to us to be more uſeful and ingenious, has been communicated to us by the reverend Charles Findlater, miniſter of Newlands in Tweeddale. It is the contrivance of Mr Charles Alexander, a farmer in Mr Findlater's neighbourhood, and has long been employed by him for the purpoſe of relieving choaked cattle. The following is Mr Alexander's conſtruction of his inſtrument, as politely deſcribed to us by Mr Findlater.

403 Mr Alexander's probang.

Take three ſmall canes, of the thickneſs of the little finger, or thereabouts, of the length of 5½ feet, that they may reach down the throat, and into the ſtomach of the largeſt ox. Theſe canes are to be bound together by ſtrong ſmooth twine rolled tightly about them (the circles of the twine touching each other), from top to bottom. Bees wax is then to be rubbed along the twine, to fill up any inequalities, and the whole rod is to be well oiled before it is uſed. There is a round knob at each end, the larger 2½ inches in diameter for larger cattle; the other leſs for leſſer cattle. Theſe knobs are formed of the twine rolled hard, and when formed may be ſtrengthened in their poſition, by being ſewed by means of a ſhoemaker's awl or *brog*, and a waxed briſtled thread, ſuch as they employ. The thread knobs are made tapering up the canes from their broad extremity; but it muſt be remarked that the ſurface of this extremity is not rounded like a clue, but hollowed into the form of a cup. The intention of this hollowed form is, to make certain of catching hold of the obſtructing body; as, if the knob was round, it might paſs by it. After the knobs are formed, they are covered with ſoft leather, which by its flexibility will adapt itſelf to the hollow end of the knob as ſoon as it reaches an obſtacle. The knobs muſt be ſecurely fixed to the canes, for if they fall off, they leave an indigeſtible ſubſtance in the ſtomach. Such is Mr Alexander's probang, the only improvements on which that we would adviſe are, to make the knobs of ſponge, firmly faſtened to the canes, by paſſing twine through holes bored in them, and adding at each end two or three bights of twine, for the purpoſe of catching hold of any obſtacle, thus making the inſtrument almoſt exactly like a ſurgeon's probang. We think the ſponge preferable to the twine, as it will not be ſo liable to injure the animal's throat by its hardneſs, will adapt itſelf more readily to the form of the obſtacle, and may be more firmly fixed to the canes.

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404 Over-feeding or fog-ſickneſs.

When cattle are put into a field of young clover, or rich graſs, eſpecially if they have previouſly been kept on poor or dry fodder, they are apt to eat voraciouſly of their new repaſt, and the young ſucculent food, when received into the ſtomach, ſoon ferments, and produces ſuch a quantity of air, as to ſwell the ſtomach to a violent and dangerous degree. Cattle thus affected are ſaid to be *over-fed*, *hove*, or *blown*; or the affection of the ſtomach thus produced, is called *over-feeding*, or ſometimes *fog-ſickneſs*. If not ſpeedily relieved, the animal's ſtomach not unfrequently burſts, from the inability to evacuate the accumulated air; for there ſeems, in theſe caſes, to be a conſtriction of the gullet; ſo that the air cannot eſcape upwards, while the number of ſtomachs, and the ſpaſmodic contraction produced by the unuſual diſtention, prevents its paſſage by the anus.

The neceſſity of ſpeedily relieving the animal, prompted the employment of what muſt at firſt have been conſidered as a very deſperate remedy; namely, ſtabbing the animal. An opening is made with a ſharp penknife into the paunch, in the thin part between the laſt rib and the huckle bone; and through this the air rapidly eſcapes. Sometimes the barrel of a quill is inſerted into the wound, to prevent its cloſing before all the air that is produced during the fermentation of the food, has eſcaped.

Stabbing the animal, is a remedy that ſhould not be had recourſe to, but on the moſt urgent neceſſity; as the wound can ſeldom be made with ſuch nicety as not to wound ſome important organ, eſpecially ſome large blood-veſſel. Indeed frequently the diſtenſion of the ſtomach, and conſequently of the ſkin and muſcles of the belly, is ſo great, that the moment the knife is introduced, a dreadful rent takes place, producing ſuch a wound, as may be attended with fatal conſequences.

Happily this operation is not often neceſſary, as it is found that the adminiſtration of ſome internal ſtimulating medicines will check the fermentation of the green fodder, and promote the abſorption of the extricated air. Many farmers have for ſome time given tar with this intention, adminiſtering an egg ſhell full to each beaſt; of late, however, the uſe of ardent ſpirits has been introduced, and it is found that a pint or mutkin

of

Diſeaſes. of whiſky or gin, mixed with an equal quantity of water, is the moſt efficacious remedy. Laudanum has alſo been recommended, but probably it is not ſuperior to common ſpirits (D).

It has been the practice with ſome farmers, to introduce on theſe occaſions, the common rope employed in caſes of choaking, into the ſtomach, and move it up and down, ſo as to produce a gradual evacuation of the air; but we ſhould ſuppoſe that the evacuation produced in this way muſt be extremely ſlow.

405 Dr Monro's flexible tube.

Dr Monro ſenior, profeſſor of anatomy in the univerſity of Edinburgh, ſome years ago contrived an elaſtic tube, that might be introduced down the throat into the ſtomach of the animal, and thus ſpeedily and effectually evacuate the air. A deſcription of this inſtrument, and the manner of employing it, appeared in an Edinburgh newſpaper, we believe, with the doctor's authority. It has ſince been publiſhed in a popular treatiſe on the diſeaſes of black cattle, entitled "Rowlin's Complete Cow-Doctor," from which we have taken it.

The doctor begins by obſerving, that the ſwelling of the belly is owing to the diſtention of the ſtomachs by fixed air, diſengaged from the ſucculent graſs in conſequence of fermentation, the diſcharge of which by the mouth ſeems to be prevented by a ſpaſmodic contraction of the upper orifice of the ſtomach. He concludes that the cattle may with certainty be ſaved, if the air be drawn off in due time, without injuring the ſtomach and bowels; and he affirms that this may be done with great eaſe by paſſing a flexible tube down the gullet into the ſtomach.

The tube is to be compoſed of iron wire, as large as a common ſtocking wire, or about one ſixteenth part of an inch diameter, twiſted round a ſmooth iron rod, three eighths of an inch diameter, in order to give it a cylindrical form; and after taking it off the rod, it is to be covered with ſmooth leather.

To the end of the tube, which is intended to be paſſed into the ſtomach, a braſs pipe, two inches long, of the ſame ſize as the tube, and pierced with a number of large holes, is to be firmly connected.

To prevent the tube from bending too much, within the mouth or gullet, in time of paſſing it down into the ſtomach, an iron wire, one eighth of an inch diameter, and of the ſame length as the tube, is put within it, which is to be withdrawn, when the tube has entered the ſtomach.

He has found that the ſpace from the fore teeth of the under jaw, to the bottom of the firſt ſtomach of a large ox, meaſures about ſix feet, and he has paſſed ſuch a tube, five feet and nine inches long into the gullet and ſtomach of a living ox. The tube ought therefore to be ſix feet long, that we may be ſure of its anſwering in the largeſt oxen.

After the tube is paſſed into the ſtomach, it may be allowed to remain for any length of time; as when it is preſſed to one ſide of the throat, it does not intercept the breathing of the animal. The greateſt part of the elaſtic and condenſed fixed air, will be readily diſcharged through the tube; and if it be thought neceſſary, the remainder of it, or the ſuperfluous drink, may be ſucked out, by a bellows fixed to the upper end of the tube, with a couple of valves, one at its muzzle, and the other at the ſide of it, ſo diſpoſed as to allow the air to paſs in the direction from the ſtomach upwards. Diſeaſes.

By means of ſuch a tube, the air is not only more certainly diſcharged than by ſtabbing the animal; but the dangers avoided which the ſtabbing occaſions, not ſo much by the irritation which the wound creates, as that the air, and the other contents of the ſtomach, getting into the cavity of the belly, between the containing parts and the bowels, excite ſuch a degree of inflammation as frequently proves fatal to the animal. This tube may be alſo uſeful for the purpoſe of introducing ſtimulant medicines into the ſtomach, when the contraction at the upper orifice would prevent their being given without ſome ſuch contrivance.

An inſtrument of this kind is ſold in London, at Macdougal's, N° 15, Great Wind-Mill Street. It ſhould be made of various ſizes, for ſheep, as well as cattle. According to Mr Blaine, Mr Eages of Graffham farm, near Guildford, has ſimplified this mode of relief much, by the invention of an inſtrument, for which he was rewarded by the Society for the encouragement of Arts, with fifty guineas. This is ſimply a cane of conſiderable diameter, and ſix feet in length for oxen; to which is affixed a knob of wood, at the end to be introduced into the ſtomach. That for ſheep is conſiderably ſmaller, and three feet long. This inſtrument, for its ſimplicity, is much to be preferred, as it is found to occaſion the evacuation of the air as effectually as the other. In caſes of emergency, and in a judicious hand, the flexible part of a common cart whip might anſwer the end.

Flatulence may be produced in horſes, by eating greedily of rich food, to which they have been unaccuſtomed, or after having faſted long; eſpecially if they drink much water immediately after. A horſe in this ſtate ſhould not be taken out to work, as, from the diſtenſion of the ſtomach, there is danger of injuring the horſes wind, or even in ſome caſes of burſting the ſtomach. If the diſtenſion has not proceeded to a great length, and if the horſe is not coſtive, gentle friction on the belly, and adminiſtering a ball made of ſome of the cordial ſeeds, will generally procure relief; but if the complaint proceeds to a great height, and there is griping pain, attended with coſtiveneſs, it becomes a caſe of flatulent colic; the deſcriptions and treatment of which will be conſidered in the next ſection.

406 Acute indigeſtion.

When this flatulence comes to a great height, it informs the diſeaſe that is commonly called acute indigeſtion. It very commonly ariſes from the horſe eating voraciouſly, after having been kept without food for many hours; eſpecially if the food then given him be of a flatulent kind, ſuch as grains or draff, young ſweet graſs, clover, or the like. The horſe's ſtomach being naturally ſmall, is eaſily diſtended by an unuſual quantity of food, or by the air diſengaged from ſuch as eaſily runs into fermentation. Hence ariſe ſwelling and tightneſs of the ſtomach, and acute pain. The horſe diſcontinues eating,

(D) The uſe of ſpirits in theſe caſes was, we believe, firſt introduced by Dr Whytt of Edinburgh, who was in the habit of adminiſtering a pint (mutchkin) of gin on theſe occaſions.

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eating, holds out his head, and appears exceedingly diſtreſſed; he looks anxiouſly and mournfully at his ſide, ſtamps with his feet, and breaks out into cold ſweats. If he is not ſoon relieved, the head becomes affected, and there appear evident marks of preſſure on the brain. Symptoms very ſimilar to thoſe of ſtaggers follow, and the horſe commonly dies apoplectic, or the ſtomach burſts.

As this affection is ſo dangerous, immediate relief is neceſſary. Stimulant medicines, ſuch as are called carminatives, as oil of aniſeſeeds, eſſence of peppermint, or oil of turpentine, ſhould be immediately adminiſtered; and if there appears much determination of blood to the head, which may be known by a ſwelling and heavineſs of the eyes, and the violent throbbing of the arteries of the temples, it will be neceſſary to draw blood pretty largely by opening one of theſe arteries. If the horſe is bound in the belly, he muſt be raked, and have a ſtrong purgative clyſter with ſome aromatic ſubſtance in it, as aniſeſeeds, or carraway ſeeds.

407 Poiſon.

All theſe animals may occaſionally ſwallow poiſon, and the treatment in theſe caſes muſt depend in a great meaſure on the nature of the poiſonous ſubſtance, where this can be aſcertained. It is ſeldom that a horſe, cow, or ſheep is poiſoned; but in the dog, this may frequently happen, either from accidents, or deſign. Dogs often pick up *nux vomica*, (which is the poiſon moſtly uſed by warreners,) and which uſually cauſes convulſive fits, and ſoon kills. Apply immediately the following remedy. As much common ſalt as can be got down; hold the head upwards, and force open the mouth, and by fixing a ſtick acroſs, prevent its ſhutting, whilſt the throat is filled with ſalt; a ſufficient quantity to purge and vomit will ſoon diſſolve, and be ſwallowed; the ſtomach once cleared by a free paſſage obtained by ſtool, warm broth ſhould frequently be given to prevent the faintneſs which might otherwiſe prove fatal. Two table ſpoonfuls of *caſtor oil*, added to the ſalt, would very much accelerate its action downwards.*

* *Daniel's Rural Sports.*

Arſenic is frequently given to dogs by deſign, or it may be picked up by them in places where it has been laid for rats. If the accident is diſcovered ſoon, the dog may ſometimes be recovered by giving him a vomit of white vitriol, and drenching him well with ſweet oil and milk; and when moſt of the poiſon appears to have been thrown up, the reſt may probably be rendered harmleſs by repeated doſes of liver of ſulphur.

If a horſe is poiſoned, the danger is very great, as from his inability to vomit, the ſtomach cannot be cleared of the poiſon. But fortunately this accident ſcarcely ever happens; as arſenic, the moſt common poiſonous ſubſtance, will produce little effect on the horſe, unleſs given in a very large doſe.

408 Worms.

The ſtomach and bowels of all theſe animals may be infeſted by worms, but theſe are moſt common in the horſe and dog.

The worms that moſt commonly infeſt the horſe are what are commonly called the *bots*. They are not properly worms, but are the larvæ of ſeveral ſpecies of the *Oeſtrus* or *Gadfly* mentioned in N° 337.

409 Bots, Oe. equi.

The horſe is attacked by 2 or 3 ſpecies of *Oeſtrus*, but more eſpecially by the *Oe. equi*, which depoſites its eggs in ſuch a manner as that they ſhall be received into the animal's ſtomach, where they form the bots.

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The method purſued by the parent fly, in order to lay its eggs in the moſt favourable ſituation for being received into the ſtomach of the horſe, is extremely curious. It is thus related by Mr Bracy Clark, who appears to have witneſſed the proceſs.

"When the female has been impregnated, and the eggs are ſufficiently matured, ſhe ſeeks among the horſes a ſubject for her purpoſe, and approaching it on the wing, ſhe holds her body nearly upright in the air, and her tail, which is lengthened for the purpoſe, carried inwards and upwards. In this way ſhe approaches the part where ſhe deſigns to depoſit the egg, and ſuſpending herſelf for a few ſeconds before it, ſuddenly darts upon it, and leaves the egg adhering to the hair, by means of a glutinous liquor ſecreted with it. She then leaves the horſe at a ſmall diſtance, and prepares a ſecond egg, and poiſing herſelf before the part, depoſits it in the ſame way. The liquor dries, and the egg becomes firmly glued to the hair. This is repeated by various flies, till four or five hundred eggs are ſometimes depoſited on one horſe. The ſkin of the horſe is always thrown into a tremulous motion on the touch of this inſect, ariſing from the very great irritability of the ſkin and muſcles at that ſeaſon of the year, occaſioned by the continual teaſing of the flies. The inſide of the knee is the part on which theſe flies ſeem to prefer depoſiting their eggs, and next to this the ſide, and back part of the ſhoulder. It is curious that theſe parts are what are moſt expoſed to be licked by the animal. In licking, the eggs adhere to the animal's tongue, and are carried into the ſtomach with the ſaliva.

"The bots attach themſelves to every part of the horſe's ſtomach, but are uſually more numerous about its farther orifice, and are ſometimes, though leſs frequently, found in the bowels. Their number varies conſiderably; ſometimes there are not above half a dozen; at others they exceed 100. They moſt uſually hang in cluſters, fixed by the ſmall end to the inner membrane of the ſtomach, to which they adhere by means of two ſmall hooks.

"The body of the *larva* is compoſed of eleven ſegments, all of which, except the two laſt, are ſurrounded with a double row of horny briſtles, directed towards the truncated end, and are of a reddiſh colour, except the points, which are black. Theſe *larvæ* evidently receive their food at the ſmall end by a longitudinal aperture which is ſituated between the two hooks or *tentacula*. The lips of this aperture appear ſomewhat hard, horny, and irregular.

"Their food is probably the chyle, which, being nearly pure aliment, may go wholly to the compoſition of their bodies without any excrementitious reſidue, though on diſſection the inteſtine is found to contain a yellow or greeniſh matter, which is derived from the colour of their food, and ſhews that the chyle as they receive it is not perfectly pure.

"The ſlowneſs of their growth and the purity of their food muſt occaſion, what they receive in a given time to be proportionally ſmall; from which probably ariſes the extreme difficulty there is found in deſtroying them by any medicine or poiſon thrown into the ſtomach. After opium had been adminiſtered to a horſe labouring under a caſe of locked jaw for a week, in doſes of one ounce every day, on the death of the animal I have found the bots in the ſtomach perfectly alive. Tobacco

has

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has been employed in much larger quantities in the ſame complaint, and has been alſo longer continued, without deſtroying them. They are alſo but rarely affected by the draſtic purgatives, which bring away in abundance the *Teniæ* and *Aſcarides*."*

* *Linnæan Tranſ.* vol. iii. p. 198.

Mr Clark does not apprehend they are ſo very injurious to the horſes as is generally conceived. When removed from the ſtomach a deep impreſſion remains where they adhered, but whether they ever irritate it ſo as to bring on a fatal ſpaſm of the ſtomach itſelf, or of the *pylorus*, or, by collecting round this paſſage, prevent the food from entering the inteſtine, has never been inveſtigated with ſufficient accuracy. The ignorant ſurpriſe of farriers on opening the ſtomach after death, and being preſented with ſo ſingular an appearance as the bots, has without doubt very often occaſioned the death to be attributed to theſe, though it is certain but few horſes on our commons can eſcape them.

Inſtances have occurred of violent inflammation excited in the ſtomach by the bots. An example of this is related by Mr James Clark. He was once deſired by a farrier in the neighbourhood who was indiſpoſed, to viſit a horſe that had been a patient of his for ſome days, and report the ſituation he was in. When Mr Clark entered the ſtable, the ſervant was giving the horſe a drink, which he was afterwards informed was compoſed of an infuſion of linſeed, in which was diſſolved one ounce of nitre, with honey to ſweeten it; and in the laſt hornful was poured, from a ſmall phial, about half an ounce, or more, of ſpirits of hartſhorn. The horſe ſeemed very uneaſy after the drink, he was ſoon ſeized with a violent trembling and ſhaking, a profuſe ſweat broke out all over his body, and run down his ſides, as if water had been poured on him; at the ſame time his legs and ears were quite cold; he lay down ſeemingly in great agony; he was ſoon after convulſed all over, and died in about half an hour from the time the drink was ſwallowed. Mr Clark obtained leave to take out his ſtomach where he was, on condition he ſhould ſew up the ſkin afterwards, in order to prevent any bad ſmell in the ſtable, till he could be carried off. On inſpecting the ſtomach, the coats of it were found greatly inflamed, and a mortification had taken place on one ſide, where it appeared of a darker colour, and here there was a ſmall hole, through which a lead probe paſſed into the cavity of the ſtomach from the outſide; the coats of the ſtomach were conſiderably thickened, and of a darkiſh red colour reſembling the liver; at the ſame time the ſtomach was conſiderably diſtended and full of food: on turning it inſide out, an incredible number of *bots* were found ſticking all round the ſide and lower part of it, ſo that it appeared entirely covered with them, ſticking as cloſely to one another as bees in a honeycomb; and ſo firmly were the heads of theſe vermin fixed in the coats of the ſtomach, that endeavouring to pull ſome of them off when alive, they broke in two, and their heads remained ſticking in the coats of the ſtomach.

The great irritation produced by ſuch a number of theſe worms ſticking in the coats of the ſtomach had no doubt occaſioned at firſt an inflammation there, and from its continuance this was tending to a mortification, before the drench was given, and would have occaſioned the horſe's death.†

† *Clark on Prevention.* 410 Oe. Hæmorrhoidalis.

Another ſpecies of *Oeſtrus*, viz. the *hæmorrhoidalis*, alſo produces eggs, which when received into the ſtomach of the horſe become bots. This inſect has been termed *hæmorrhoidalis* from the appearance of the bots when coming out of the anus of the horſe, when they are very like the ſwelling produced by the piles or hæmorrhoids. It was ſuppoſed by Linnæus and ſome other naturaliſts, that this and the laſt ſpecies introduced their eggs into the bowels of the horſe, by entering the *rectum*, *more per anum intrans*; but this opinion is now fully refuted. Diſeaſes.

The part choſen by this inſect for this purpoſe, is the lips of the horſe, which is very diſtreſſing to the animal from the exceſſive titillation it occaſions; for he immediately after rubs his mouth againſt the ground, his fore legs, or ſometimes againſt a tree; or if two are ſtanding together, they often rub themſelves againſt each other. At the ſight of this fly, the horſe appears much agitated, and moves his head backwards and forwards in the air, to baulk its touch, and prevent its darting on the lips; but the fly, watching for a favourable opportunity, continues to repeat the operation from time to time; till at length finding this mode of defence inſufficient, the enraged animal endeavours to avoid it, by galloping away to a diſtant part of the field. If it ſtill continues to follow and teaſe him, his laſt reſource is in the water, where the *Oeſtrus* is never obſerved to follow him.

The teaſing of other flies will ſometimes occaſion a motion of the head ſimilar to this; but it ſhould not be miſtaken for it, as it is never in any degree ſo violent, as during the attack of the *Oeſtrus*.

At other times the *Oeſtrus* gets between the fore legs of the horſe while he is grazing, and thus makes its attack on the lower lip; the titillation occaſions the horſe to ſtamp violently with his fore feet againſt the ground, and often ſtrike with his foot, as aiming a blow at the fly. They alſo ſometimes hide themſelves in the graſs; and as the horſe ſtoops to graze, they dart on the mouth, or lips, and are always obſerved to poiſe themſelves a few ſeconds in the air, while the egg is preparing on the point of the *abdomen*.

When ſeveral of theſe flies are confined in a cloſe place, they have a particularly ſtrong fuſty ſmell; and I have obſerved both ſheep, and horſes, when teaſed by them, to look into the graſs, and ſmell to it very anxiouſly; and if they by theſe means diſcover the fly, they immediately turn aſide, and haſten to a diſtant part of the field.

The eggs of this ſpecies appear of a darker colour than the former, and we are unacquainted with the circumſtances attending their paſſage to the ſtomach.

The *larvæ* of the *Oeſtrus hæmorrhoidalis*, as well as the former ſpecies, appear to have been termed among the Romans, *coſſus*, which ſeems to have been a general expreſſion for any kind of ſoft imperfect animal, and to have been very analogous, and as extenſively applied as the word *grub* is at preſent in the Engliſh language.* 411

* *Linn. Tranſ.* vol. iii. p. 310.

Symptoms of bots.

The preſence of bots in the horſe's ſtomach and bowels, is not always eaſily aſcertained, as it is certain that great numbers have been found in the ſtomach after death, without appearing to have produced any unuſual ſymptoms in the animal while alive. When, however, they have collected in any great numbers, or when the animal's ſtomach is peculiarly irritable, they are attended with the following ſymptoms. The horſe has a diſpoſition

Diſeaſes. poſition to rub his tail frequently, without any apparent humour or eruption that ſhould make it itchy; he eats heartily, and is yet always lean and out of condition. His coat is rough and ſtaring, ſuch as we have deſcribed it to be in what is called a *ſurfeit*. There is alſo a ſickly paleneſs of the mouth and tongue, attended with an unwholeſome cadaverous ſmell. The horſe appears tucked up in his flanks, which often heave; he turns his head now and then, and ſtrikes his belly with his hind feet. Theſe latter ſymptoms indeed, as they only indicate griping pains, and often occur in ordinary colic, are not to be relied on, unleſs accompanied with the former. In caſes of worms, it is ſaid that the dung is yellowiſh, like melted ſulphur, or is otherwiſe diſcoloured and very offenſive. The ſureſt mark, however, of the preſence of bots is their being voided by the anus, where they are ſometimes found ſticking.

411 Treatment. As the bots are extremely tenacious of life, it is very difficult to expel them, and where they do not occaſion any conſiderable irritation or other bad ſymptoms, it will be better to let them alone till they come away ſpontaneouſly. But when it is judged neceſſary to attempt their expulſion, this may be done by adminiſtering the ſal indus, as directed in N° 60 of the receipts, and after it a ſtrong doſe of calomel and aloes.

We have ſaid the bots are not properly worms; but there are ſeveral ſpecies of worms that are very frequent in dogs, and are now and then found in the horſe. Theſe are the *lumbrici*, or *long round worms;* the *aſcarides*, or *thread worms;* and the *tæniæ*, or *tape-worms*.

412 Lumbrici. The long round worms are ſeldom met with in theſe animals; but when they occur in the horſe, they produce much uneaſineſs, and ſometimes occaſion colic and inflammation of the bowels. It is very difficult to expel theſe worms, as the only remedies by which this could be properly attempted, ſuch as powdered tin and ſtrong purgatives, cannot with propriety be often given to a horſe, as, from the ſtructure of his ſtomach, the former might produce conſiderable injury, and the latter are extremely debilitating.

413 Aſcarides. *Aſcarides* are now and then found in the great guts of the horſe, and ſometimes prove troubleſome, but are ſeldom or never dangerous. They are beſt removed by clyſters of lime-water, followed by purgative clyſters.

414 Tape-worm. The tape-worm is ſeldom found but in dogs, where they are ſometimes the cauſe of fatal diſeaſes, eſpecially to puppies. The ſymptoms of worms in dogs are, an itchineſs of the noſe and at the anus, both of which they are perpetually rubbing againſt every thing; ſwelling and hardneſs of the belly, leanneſs, running at the eyes and noſe, and frequent purging of a ſlimy or ſtringy matter. There is alſo a peculiar ſtaring appearance of the hair, which points the wrong way.

Mr Blaine ſays that the bowels of dogs are ſo irritable, that they will ſeldom bear ſtrong phyſic, and that he knows of nothing that will certainly deſtroy the worms in their inteſtines. He has tried with variable ſucceſs, tin, quickſilver, pewter, calomel, and ſavine, with other ſubſtances, but none of them appeared ſufficiently certain to demand his confidence. When the worms are early detected, he thinks that purging doſes of the compound powder of ſcammony with calomel, prove the moſt efficacious means. Mr Daniel recommends aloes, hartſhorn, the juice of wormwood, with ſome flower of brimſtone, mixed together into a ball, about the ſize of a hazel nut, which is to be wrapped up in butter, and given three or four times a-week, letting the dog faſt for a few hours each time, which, he ſays, will deſtroy the worms. He alſo ſays that they may be deſtroyed by giving the dog as much finely powdered white glaſs as will lie on a ſixpence, for three ſucceſſive mornings, mixed up with butter; and if the worms are not voided in that time, the doſe of the glaſs is to be increaſed, and it is to be repeated for three other mornings, by which time it will ſcarcely fail of producing the deſired effect. Diſeaſes.

415 Concretions in the ſtomach. There is a ſort of concretion often met with in the ſtomachs of cattle, and ſometimes in that of horſes, which is partly compoſed of a chalky ſubſtance, and partly, or ſometimes almoſt entirely, of hair evidently ariſing from the animal's licking off their hair and ſwallowing it with their ſaliva. The maſs thus received into the ſtomach, being wholly indigeſtible, collects there, and forms theſe globular concretions which ſometimes grow to ſuch a ſize as to prove fatal.

The growth of theſe concretions is thought to be encouraged by the long uſe of hard dry food, without the animal's being allowed to feed from time to time on freſh green herbage. It is even thought that the timely uſe of freſh graſs may prove the means of diſſolving theſe concretions. Van Swieten, in his commentaries on Boerhaave, when ſpeaking of chalky matters found in the liver and other organs, remarks, that ſometimes there are concretions of the like ſort found in this organ, but of a more friable texture, and of a whiter appearance, like gypſum or plaiſter of Paris. Such incruſtations were often obſerved by Gliſſon in the pori biliarii, and its larger branches diſperſed through the livers of oxen that had been fed in ſtalls with hay and ſtraw during the winter ſeaſon and without exerciſe. But then theſe concretions are very friable, and they afterwards diſſolve again, and paſs out of the body when the cattle come to feed upon the freſh graſs of the meadows; for in oxen that are ſlain in the ſpring or ſummer, they are very rarely to be found.

"In diſſecting horſes, (ſays Mr Clark) I have frequently met with chalky concretions in their livers and in the lungs, eſpecially in thoſe that have been fed long on dry food, and likewiſe round balls in their ſtomachs, ſometimes of an oval ſhape. The latter ſeem for the moſt part to be compoſed of the duſt they lick from their own bodies mixed with the hair. Whether the freſh graſs diſſolves them is not ſo certain; but that it cauſes theſe concretions to paſs through the inteſtines, I have had a full demonſtration. In May 1786, a horſe that had been long fed on dry food was turned out to graſs; in about eight or ten days afterwards, he was ſeized with violent griping pains, which laſted for about 24 hours, when he died. As the horſe was very fat, the man who had the charge of him wanted to make ſomething of his greaſe. In ſearching for it, he obſerved a large ſpace of the inteſtines of a very black colour; and on feeling it, found ſomething hard and weighty within them. He immediately cut it open with his knife, and took out a large oval hard ball, which meaſured four inches in length, and three inches and a half in breadth, and which I have now in my poſſeſſion. That this concretion was originally formed in the

Diſeaſes.

ſtomach, there can be no doubt, as they frequently upon diſſection have been found there, and nothing but its great bulk had hindered it from paſſing through the inteſtines." *

* *Clark on Prevention*, p. 60.

The beſt means of obviating theſe concretions, is to allow the animal to feed occaſionally on freſh green fodder; and, according to what has been ſaid, this may ſometimes remove them after they are formed.

416 Loſs of appetite.

Horſes and other domeſtic animals ſometimes labour under a loſs of appetite. Animals may eat leſs than uſual, or they may refuſe to eat at all, either from a want of that ſenſation in the ſtomach, which we call hunger, or from a diſlike that the animal takes at the food that is ſet before him. Want of appetite is a ſymptom of ſeveral diſeaſes, particularly of fevers and internal inflammations. When this happens, it would be abſurd to force food on the animal's ſtomach, as it could not be digeſted, and would only aggravate the violence of the diſeaſe.

Want of appetite very often attends very great fatigue. It is alſo very frequently the effect of an improper uſe of cordial and ſtrengthening medicines. It may however, be the effect of weakneſs of the ſtomach, not brought on by thoſe means. In ſuch a caſe, cordials and tonics are very proper, and their uſe ſhould be accompanied with gentle exerciſe.

This loſs of appetite in the horſe, is commonly called *chronic indigeſtion*, and is uſually accompanied with a roughneſs and ſtaring of the coat. the ſkin having the appearance which we have deſcribed in N° 328 under hide-bound.

An affection of a ſimilar kind takes place in cattle, in whom it is called *loſs of the cud*, from their not chewing the cud as uſual. It is known by the animal's mourning, having no inclination to eat, or dropping his food, without ſwallowing it. It frequently ariſes from the ſtomach being loaded with hard food that is difficult of digeſtion, ſuch as acorns, or coarſe dry ſtraw. It may alſo ariſe from a weakneſs of the ſtomach, which is not uncommon in hot weather, and may be brought on by confinement and want of freſh air. The treatment is much the ſame as in horſes.

417 Foul feeding.

Horſes are ſubject to an affection of the ſtomach, in which they ſometimes eat voraciouſly, or greedily ſwallow ſubſtances that are indigeſtible. Horſes labouring under this complaint are called *foul feeders*, as they eat clay, mortar, dirt, foul litter, or even the dung of other animals.

This is properly a ſymptom of indigeſtion, and ſeems to be owing to a peculiar acrimony of the gaſtric juice, and in moſt caſes there is evidently an acid upon the ſtomach. The beſt remedies are bitters, and other ſtrengthening medicines, combined with ſalt of tartar, or ſome other antacid. The receipts marked 61 and 62 are well adapted to theſe caſes. Theſe remedies ſhould be aſſiſted by pure air and regular exerciſe; and where coſtiveneſs is preſent, it ſhould be obviated by the uſe of warm laxatives. Care ſhould alſo be taken to keep the ſtable clean, and to have a quantity of clean ſtraw below the manger, that the horſe may not be tempted to eat other ſubſtances that are more injurious.

418 Surfeit in dogs.

A ſurfeit is ſometimes occaſioned by hounds eating putrid fleſh, or that of horſes that have died, or been killed when violently affected with the farcy. Ariſing from the former cauſe, the fatality which attended the hounds of Mr Finch in Kent, is a curious inſtance. In drawing the covers, the hounds met with the carcaſe of a diſeaſed bullock, with which they gorged themſelves; the contamination was immediate through the pack; they were generally ſeized with ſtaggering convulſive fits, operating to ſo violent a degree, that eight couple of hounds died in the field in leſs than two hours, and it was ſuppoſed the whole pack would have fallen victims, but for the timely application of oil and other medicines. Mr Daniel, from feeding with the fleſh of horſes ſent from a poſt ſtable, in which the farcy and the glanders had ſpread their ravages, had an opportunity of ſpeaking to the latter; the hounds broke out all over in blotches, diſcharging a watery humour, ſimilar to thoſe occaſioned by the farcy; they cauſed great ſtiffneſs, and were extremely painful. This inoculation took place, notwithſtanding moſt of the horſes were ſent alive to the kennel, and were properly ſlaughtered, and none of the fleſh was given raw to the hounds. Phyſic, and taking them frequently to the ſalt water, and well rubbing the ſores by hand with it, at length recovered them. For checking a common ſurfeit, ox gall and train-oil, equal quantities; the affected parts to be well rubbed, and ſome phyſic taken inwardly will quickly reſtore them *.

Diſeaſes.

* *Daniel's Rural Sports.*

419 Rupture.

There are two diſeaſes that affect the bowels, which we cannot conſider more properly than at the end of this chapter. Theſe are *rupture* and *falling of the fundament*. Theſe may take place in any of the domeſtic animals, but they are more common in horſes, as they are moſt frequently the effect of great exertion. *Burſtenneſs* or *rupture*, commonly proceeds from ſtrains in labour, kicks on the belly, high and difficult leaps, eſpecially when heavy laden. It may be produced by the goring of oxen, by being ſtaked, and by various other accidents. Gibſon ſays that he has known it produced by too deep an inciſion being made in inſerting a rowel.

The bowel may be ruptured either at the navel, or through the rings at the back part of the belly into the ſcrotum or cod. The tumour, when not too large, will return on being preſſed, as if it were merely flatulent, and the rupture or chaſm may be felt. It is eaſy to conceive that ſuch a defect is incurable, excepting poſſibly in a very ſlight caſe, and a very young ſubject; the intention muſt be to palliate, to render the animal as uſeful as poſſible, and as comfortable to itſelf. In a recent caſe, bleed, and give emollient and oily clyſters, boiled barley, malt maſhes, nitrated water. Foment twice a day with camphorated ſpirits, and vinegar warm; and poultice with oatmeal, oil, and vinegar.

420 Falling of the fundament.

Falling of the fundament is ſometimes occaſioned by a long-continued looſeneſs, and is moſt likely to be produced in ſuch animals as are of a weak and delicate conſtitution, but it is frequently brought on by hard riding or hard driving. Mr Lawrence ſays, that he has frequently ſeen it in hard-driven pigs. According to Soleyſel, it is in horſes ſometimes the conſequence of docking.

When this complaint is firſt ſeen, it may in general be eaſily cured. The gut ſhould be returned as ſoon as poſſible, by puſhing it up with the ends of two or three fingers wrapt round with a piece of ſoft linen rag gently greaſed; but before returning the gut it ſhould be bathed with ſome aſtringent lotion, as a ſolution of

Diſeaſes. of alum or white vitriol, or port wine and water; and a little of either of theſe ſhould be frequently injected. If the gut ſhould become inflamed, it muſt be anointed with ſome cooling liniment, ſuch as receipt N° 78. Care muſt be taken to keep the animal's bowels open, by frequent bran mathes. If the complaint continues obſtinate, nothing will effectually remove it, but cutting off a part of the protruded gut. This may be done with a common ſurgeon's knife, called a *ſcalpel*, but it is ſometimes performed with a ſharp red-hot cautery. The wound commonly ſoon heals, but the animal ſhould not be worked for ſome time after; but ſhould be allowed a long run at graſs, or in a ſtraw yard.

Chap. IV. *Morbid Affections of Abſorption.*

421 The abſorbent veſſels of the human body have been deſcribed in the article Anatomy; and the ſtructure of theſe veſſels, in the animals now under our conſideration, is ſufficiently ſimilar to render a particular deſcription of them here unneceſſary. The function of abſorption, and the derangements produced in it by diſeaſe, will be explained under thoſe medical articles that have for their object *phyſiology* and *pathology*. It will be ſufficient for us, in this place, to remark, that many of the diſorders of the animal frame, are greatly influenced by the ſtate of the abſorbent ſyſtem; and that ſome complaints ſeem chiefly to depend on the loſs of the proper balance between the function of abſorption, and that of circulation. Sometimes the abſorbent veſſels are too active, while the circulating ſyſtem is proportionally languid; at others the abſorbent ſyſtem is languid, while that of the circulation is either unuſually active, or continues in its natural ſtate. The former ſeems to be the cauſe of leanneſs, coſtiveneſs, and ſome other morbid affections; to the latter may be referred the ſeveral ſpecies of dropſy. We ſhall here only conſider two of theſe affections, leanneſs, and ſwelled legs, as moſt of our readers will expect coſtiveneſs treated of as a morbid affection of *excretion*, and moſt of the ſpecies of dropſy muſt be conſidered as general affections of the ſyſtem; and therefore to be explained in the next ſection.

422 Leanneſs. An unnatural degree of leaneſs may take place from many cauſes; as, 1ſt. From the want of a proper ſupply of food, whether from this being diſpenſed too ſparingly in proportion to the labour of the animal, or from its not being ſufficiently nouriſhing. Hence we ſee that ſuch horſes and dogs as are hard worked and ill fed, are extremely lean.

2d. In ſtallions leanneſs is often the effect of being ſuffered to cover too often, or too long at one ſeaſon.

3d. It is a common attendant on ſeveral acute diſeaſes, as fevers, ſome inflammations, eſpecially dyſentery, or what has been commonly called *molten greaſe*.

4th. Leanneſs is a common attendant on old age.

This ſymptom requires little attention, as it is ſeldom dangerous, except when it comes on very rapidly, and is attended with great weakneſs, and manifeſt ſigns of decay, in ſtallions that are too *hard worked*. It commonly ſoon diſappears after the cauſe that produced it, or the complaint of which it is a ſymptom, is removed.

423 Swelled legs. A ſwelling of the legs is very common to horſes that are ſuffered to ſtand long in the ſtable, without being worked, or in ſome other caſes that will preſently be mentioned. There is a ſwelling of the legs that is the conſequence of hard work, ſtrains, or other cauſes, that excite inflammation; but what we are now conſidering is a dropſical ſwelling, conſiſting in an accumulation of watery fluid below the ſkin, ſimilar to the ſwelled legs of old people, and *chlorotic* girls. It may affect all the legs, but it is more commonly confined to the hinder extremities. The ſwelling generally takes place above the paſtern and fetlocks; but if it continues long, it extends further up the legs, and the ſkin ſometimes cracks, and there oozes out a watery fluid, or ſometimes a purulent or greaſy matter. In this laſt caſe it has degenerated into greaſe, which will be conſidered hereafter. Diſeaſes.

Swelled legs frequently take place in horſes that are newly brought into the ſtable, or a ſtraw yard; eſpecially if they are not regularly worked, and their legs regularly rubbed down, at leaſt twice a day. It is more certainly produced, if the horſe ſhould be ſuffered to ſtand long on hot litter. It is alſo not uncommonly the effect of wading through ſnow or cold water, eſpecially when the legs are heated. It evidently depends on a decreaſed action of the abſorbent veſſels and veins of the legs.

It may in general be prevented by regular exerciſe, and frequent rubbing: but if it ſhould occur in a horſe that is too full of blood, it may be neceſſary to bleed and phyſic. If the ſwelling ſhould continue obſtinate, it will be proper to apply a bliſter to the part, or to rub the legs frequently with ſome ſtimulating liniment, and if the complaint is of long ſtanding, it may be proper to inſert a rowel in each leg; and the diſperſion of the ſwelling may be aſſiſted by rolling hay bands round the legs, by way of bandage. One of the moſt effectual means of preventing a return, will be firing, making perpendicular lines with the cautery from the fetlock to the coronet. Regular exerciſe and friction muſt be perſiſted in; and if the complaint is accompanied with general weakneſs of the ſyſtem, a nouriſhing diet, and ſtrengthening remedies muſt be added.

Chap. V. *Morbid Affections of Circulation.*

424 Pulſe in various animals. The pulſe in the inferior animals has been very little attended to by veterinary practitioners; indeed the common farriers and cattle doctors ſcarcely know whether their patients have a pulſe, or where it may be moſt readily felt.

The ſtrength and frequency of the pulſe in its natural ſtate, differs very much in the ſeveral ſpecies of the domeſtic animals. It is in general ſtronger according to the ſize of the animal; but its frequency diminiſhes in the ſame proportion, it being quicker in the ſmaller than in the larger animals, even of the ſame ſpecies. We cannot undertake to ſtate exactly the average frequency of the pulſe, in the ſeveral animals, and the accounts given by different authors vary conſiderably. Mr Clark ſays that the pulſe of a horſe in health, and no way terrified or alarmed, is from 36 to 40 beats in a minute. According to Mr Blaine, it ranges from 45 to 55, being generally from 45 to 50 in large horſes, and from 50 to 55 in ſmaller horſes. Dr Hales found that the pulſe of an ox in health, did not exceed 38 beats in a minute.

Diſeaſes. Mr Blaine, in his firſt volume, ſtates the medium pulſe of a dog at 80 or 90; but in his ſecond volume p. 149, he ſays, that a dog has uſually from 90 to 100 or 110 contractions in a minute, ſo that we may probably take the average at from 90 to 100. Perhaps the pulſe of a ſheep is ſlower by about 10 beats than that of a dog.

425 Feeling the pulſe. The pulſe in the inferior animals may be moſt conveniently felt in the temporal arteries, which as we have ſaid in N° 164 are ſituated a little backwards above the outer angle of the eye. It may be felt alſo at the corner of the lower jaw, on each ſide of the fetlock joint, on the inſide of the hock, and at the heart.

As much is to be learned from the pulſe, reſpecting the nature of many diſeaſes, and the degree of danger which they indicate; we earneſtly recommend to our practical readers, that they take every opportunity of examining the pulſe of theſe animals, when in a ſtate of diſeaſe. We cannot here enter with propriety into an explanation of the morbid varieties of the pulſe, as it would be only to repeat what is given in the pathological part of our work, to which we refer our veterinary readers; as the obſervations there delivered can be eaſily applied to the particular caſes of horſes, cattle, ſheep, and dogs, by keeping in view the natural ſtate of the pulſe, in each ſpecies as above laid down.

426 There are two general ſtates of the ſyſtem, that may take place in all animals, and which are chiefly diſtinguiſhed by the ſtate of the circulation, as aſcertained by the pulſe. Theſe are plethora, or fulneſs of habit; and debility, weakneſs, or inanition. The former is always attended with a fulneſs, and ſometimes a hardneſs of the pulſe; while in the latter, the pulſe is weak and ſmall, eaſily compreſſed or ſtopt by the finger, and is ſometimes ſlower, but oftener much more frequent than natural.

427 Plethora. When an animal has been kept for ſome time on a full nouriſhing diet, while he is at the ſame time confined within doors, and deprived of that regular exerciſe, which is neceſſary to carry off ſuperfluities, he becomes fat, corpulent, and full of blood, or what we call *plethoric*. In this ſtate the veins below the ſkin, from their being greatly diſtended with blood, are very prominent, excepting in thoſe parts where they are bedded in fat; the pulſe, is as we have ſaid, full, and commonly ſtrong, but in ſome caſes it feels oppreſſed, as if the quantity of blood were too much for the cavity of the artery. The pulſe in theſe caſes is frequently ſlower than natural. The animal becomes dull and ſluggiſh, averſe to motion, and if he is obliged to exert himſelf, evidently does ſo with difficulty, pants, and labours, and becomes ſoon fatigued.

This plethoric ſtate is extremely common in horſes and dogs that are pampered with high living, and little or no work. A horſe in this ſtate, though he may look well, is far from being in good condition, and is by no means fit for active labour. In fact, if ſuch a horſe is put to hard work, before he is properly prepared for it, there is the greateſt probability that he will be completely ruined. Inſtances occur every day of full fed idle horſes knocking up, or even dying on the road, and a long liſt of violent diſeaſes is the conſequence of this plethoric ſtate of body. It lays the foundation of broken wind, inflammation of the lungs, phrenſy, and above all of ſtaggers, or apoplexy. It is no uncommon thing to ſee a fat well-looking horſe, fall down in convulſions, while drawing a heavy load, owing to the determination of blood to the head, from ſo great an exertion, while the veſſels are too much diſtended. Moſt lap dogs and others who are parlour gueſts, commonly die of apoplexy. A lady of our acquaintance had a fine fat lapdog, who ſeldom quitted the cuſhion that formed his bed, beſide his miſtreſs's chair, where he was fed with the niceſt bits from the dinner table. *Jack* had been unuſually heavy for a day or two, and one morning was found lying dead on his cuſhion; *though* he had the night before eaten a *hearty ſupper*. Diſeaſes.

To prevent the ill conſequences that muſt ariſe from this plethoric ſtate, theſe animals ſhould be regularly exerciſed, and not ſuffered to eat too much. Where the *plethora* has already taken place, and where no dangerous ſymptoms threaten the attack of ſome violent diſorder, the beſt method of bringing the animal into good condition, is to lower his diet gradually, and as gradually increaſe his exerciſe or labour; but where the ſymptoms are ſuch, as indicate approaching apoplexy, or ſome other dangerous diſorders, it will be neceſſary immediately to bleed and purge, and to take care that the animal be not put to any violent exertion, till he be brought into good condition.

We muſt here remark, that frequent bleeding with a view to obviate *plethora*, is extremely improper, as it tends to produce the very ſtate againſt which it is employed. Bleeding, therefore, ought not to be had recourſe to, except in caſes of imminent danger.

428 Hawkes, or hocks. There is a complaint that ſometimes appears among cattle, when they are ſuddenly put on high feeding, after having been long accuſtomed to a poor and ſparing diet. It is called by the graziers, *Hawkes* or *Hocks*, and is probably of an inflammatory nature, but as it ſeems to depend entirely on a ſudden diſtention of the blood veſſels, and is ſpeedily relieved by removing this diſtenſion, it may properly be conſidered in this place.

The complaint is ſaid to begin with an uneaſineſs and ſwelling about the eyes, and about the glandular parts of the throat, which extends itſelf gradually over the whole body, to the legs and joints; and in cows to the barren and udder. The animal appears languid, dull, and heavy, and ſeems unwilling to ſtir from the place where he is; and when the diſeaſe has made ſome progreſs, he will not lie down till he is relieved. The legs become cold and numb, and as the ſwelling advances towards the hind parts, a copious ſecretion of ſaliva commonly takes place from the mouth, attended often with a ſwelling about the tongue. The diſeaſe is extremely rapid in its attack and progreſs, and if it be not ſpeedily attended to, it will terminate in ſtaggers, or ſome violent inflammatory diſeaſe.

The cure of this affection ſeems to depend entirely on bleeding, which ſhould be performed as ſoon as poſſible, taking away a quart or two of blood at firſt, and repeating the operation ſome hours after, if the ſwelling is not diminiſhed. It is recommended to rub the whole body well, both before and after bleeding, and if the mouth is much affected, it will be relieved by waſhing it frequently with ſalt and water. If there is any conſiderable heat, it may be proper to give a drench with nitre every four hours.

429 Inanition. Inanition is a ſtate of body directly the oppoſite of what we have deſcribed; and is produced by very different

Diſeaſes. ferent cauſes; from ſtarvation, hard work, loſs of blood, or violent, or long continued diſeaſes.

An animal in this ſtate is lank and lean; its pulſe is ſmall and weak, his eyes hollow, his ſkin dry and hide-bound, his excrements ſmall in quantity, hard, dry, and diſcoloured, his urine thick and turbid; he takes every opportunity of grazing by the road ſide, pulling at the hedges, or eating whatever comes in his way; he becomes mangy; and if this ſtate of debility continues long, he falls into what is called an atrophy, which commonly proves fatal.

The above deſcription is chiefly applicable to thoſe animals, who either from accident or neglect, are half ſtarved. The ſtate of inanition produced from this cauſe, is frequently ſeen in horſes belonging to the lower claſs; and it is no uncommon thing to ſee dogs that have been turned out of doors, periſhing in the ſtreets in this condition. Sheep are alſo often found in a ſtate of inanition at the end of a hard winter, after having been left for months to ſhift for themſelves among the ſnow.

On opening the bodies of ſuch as have died of hunger, we find the ſtomach and bowels much contracted, and ſometimes in the former there will be a ſmall quantity of food, ſcarcely maſticated and indigeſted: Sometimes both ſtomach and bowels contain balls of earth or other indigeſtible matters; the large inteſtines are exceedingly diminiſhed in ſize, and commonly contain a quantity of dry, hardened excrement; the caul and other membranes that ſurround the inteſtines are much ſhrunk, and for the moſt part appear completely diveſted of fat; the heart and large blood-veſſels are flabby, and filled with a thin watery blood.

Though inanition is moſt frequently the effect of ſtarving, it not unfrequently follows great loſs of blood, or profuſe diſcharges from the bladder and inteſtines. It alſo not uncommonly attends an obſtruction in the gullet, in which caſe the animal can take little or nothing by the mouth, and the nouriſhment which he can receive by clyſters is little more than ſufficient to ſupport his exiſtence.

Inanition from the laſt cauſe is the moſt hopeleſs; for when it ariſes from ſtarving, loſs of blood, or profuſe diſcharges, the animal may, in moſt caſes, be brought back to good condition, by nouriſhing diet and ſtrengthening remedies, with proper attention to pure air, gentle exerciſe when he is able to bear it, and proper ſhelter from the inclemencies of the weather.

430 Wounds of arteries. It is not uncommon, either from injudiciouſneſs or want of ſkill in bleeding, or from accident, for an artery to be wounded. If the wound be large, or the artery of any conſiderable ſize, ſo much blood may be poured out as to deſtroy the animal in a ſhort time; but, if the artery be wounded by a ſmall puncture, ſuch as may be made by the point of a lancet paſſing through a vein, blood is gradually effuſed, and inſinuates itſelf in the cellular membrane below the ſkin. In this way a ſwelling is formed with an evident pulſation like the beat of an artery; and, as this enlarges, the ſkin becomes diſcoloured and diſtended, ſo as ſometimes to burſt and occaſion death by a ſudden loſs of blood. The ſwelling produced by the blood effuſed from a wounded artery has been commonly called a *falſe aneuriſm*, to diſtinguiſh it from what we are immediately to mention.

The artery that is moſt liable to be wounded in bleeding is the external carotid, which runs below the jugular vein, or ſometimes a little to one ſide of it. This accident, will, however, ſeldom happen, except when a ligature is uſed; but when this is employed, the jugular vein is preſſed ſo cloſely on the artery, that the point of the fleam or lancet may eaſily penetrate through the vein into the artery. M. Huzard alleges, that in this way even the wind-pipe may be wounded, together with the artery, and that the animal may be choaked by the effuſion of blood from the latter into the former. Diſeaſes.

When an accident of this kind has taken place, whether from bleeding, from wounds, or from the eroſion of an artery by the acrid matter of a foul ulcer, it is neceſſary to take ſpeedy means for preventing the ill conſequences that may enſue; for, though the wounded artery be not very large, ſuch an effuſion of blood may take place from it, as may greatly weaken the animal, if it ſhould not prove fatal. If the artery is very ſmall, the bleeding is eaſily ſtopped, either by applying ſuch a degree of preſſure, as may be ſufficient to obliterate the cavity of the wounded veſſel, or, what is often more convenient, by completely dividing it; after which the divided ends will contract ſo much as to prevent the further effuſion of blood. If the wounded artery be large, it can be ſecured with certainty only by means of ligature. For this purpoſe, preſſure muſt be made on the artery, between the wounded part and the heart, while an inciſion is made through the ſkin and muſcles down to the place where the artery has been wounded, ſo that this may eaſily be diſcovered. Then a pretty ſtrong thread, doubled and waxed, is to be paſſed round the artery by means of a crooked needle, with a blunt point, and is then to be tied faſt about an inch above the wounded part. A ſimilar ligature is to be fixed upon the artery at about the ſame diſtance, on the other ſide of the orifice, and the artery is to be cut acroſs between the two ligatures. Thus, the further effuſion of blood is completely prevented, and the wound may be healed in the uſual manner. The part that was ſupplied with blood by the wounded artery, will, if the veſſel was pretty large, be colder and leſs ſenſible than uſual, but it will in general be ſufficiently ſupported by the ſmall branches of other arteries that join with the wounded veſſels beyond the ligatures; and theſe branches will gradually become ſo diſtended as to ſupply the place of the divided artery, and reſtore the part to its proper functions.

431 Aneuriſm. It ſometimes happens, that part of an artery becomes unuſually dilated, forming what is called a *true aneuriſm*. This dilatation may take place in any of the arteries, but it is moſt common in the aorta or great artery within the body, and in the external carotid and popliteal arteries without. An aneuriſm of the external carotid is often ſeen in dogs, and ſometimes in horſes, eſpecially ſuch as are accuſtomed to draw heavy weights. An aneuriſm of an external artery is eaſily diſtinguiſhed, by a conſiderable pulſation, which may be felt much more ſuperficially than the ordinary beat of the artery, and is ſometimes ſo remarkable, that it can be diſtinctly ſeen by the alternate heaving and ſinking of the ſkin below which the ſwelling is ſituated. An aneuriſm of the aorta is not ſo eaſily diſtinguiſhed in the inferior animals. The diagnoſtic marks by which it may be known

Diſeaſes. known in the human body, will be given in the article SURGERY.

Theſe aneuriſms are attended with conſiderable danger, and thoſe of internal arteries commonly ſoon prove fatal. Aneuriſms of external arteries are attended with a waſting of the bones over which they lie, owing to the increaſed abſorption of bony matter produced by the pulſation of the dilated artery; and theſe ſwellings commonly burſt in no long time, eſpecially if the animal be expoſed to any great labour or exertion.

The treatment of theſe aneuriſms is exactly ſimilar to that of a wounded artery deſcribed above. It conſiſts in ſecuring the dilated artery, either by preſſure on the ſide of the aneuriſm next the heart, or by means of two ligatures, one on each ſide of the tumour.

432 Wounds of veins. An effuſion of blood into the cellular ſubſtance may take place from a vein, the orifice of which has not been properly cloſed after bleeding; or it may happen from the orifice in the vein not exactly correſponding to that in the ſkin, ſo that the ſkin gets over the orifice in the vein, and prevents the blood from flowing out. In this latter caſe there is ſaid to be a *thrombus* of the vein.

When ſuch an effuſion of blood is obſerved, it is neceſſary to dilate the orifice in the ſkin, and to take away the clotted effuſed blood from below it. If the vein does not appear likely to bleed again, it will be unneceſſary to pin it up; but if blood ſhould ſtill flow from it, it will be neceſſary to ſecure it by a pin. This, however, ſhould not be ſuffered to remain too long, as it may produce inflammation and ulceration of the vein. Sometimes it is ſo long before the effuſion of blood is obſerved, that the ſwelling is become conſiderable, and is attended with inflammation, or even ſuppuration. Where inflammation is preſent, but has not proceeded to ſuppuration, this latter may in general be prevented by keeping the part moiſt (after taking out the effuſed blood), with a ſolution of ſugar of lead in vinegar and water. If matter is already formed, the ſwelling muſt be poulticed, or frequently fomented with warm liquors; and when the matter is let out, the ſore muſt be treated as a common ulcer.

Sometimes the inſide of a vein that has been opened in bleeding inflames, ſuppurates, and becomes a fiſtulous ſore; and if this be neglected, the matter may extend to ſome important organ, as to the head, when the jugular vein has been opened, and produce death. When the vein is not very large, or the ulcerated part of it is inconſiderable, it may commonly be healed by means of the actual cautery, or firing, as deſcribed in N° 351; but if the wound is very large, or the ulceration very extenſive, it may be proper to ſecure the vein by means of ligatures applied on each ſide of the ulcerated part.

433 Varix or blood-ſpavin. When the enlargement of any part of a vein takes place, without the vein having been wounded, the ſwelling is called by medical writers *varix*, or the vein is ſaid to be *varicoſe*. This ſwelling ſeldom takes place in any of the domeſtic animals except the horſe, in whom ſometimes the ſuperficial vein that paſſes over the inſide of the heck ſometimes becomes varicoſe, and forms what farriers call a *blood-ſpavin*. The enlargement of this particular vein is always accompanied by *bog-ſpavin*, or an enlargement of the mucous capſules in the ſame part of the hock, and the former ſeems to be a conſequence of the latter, being produced by the compreſſion of the vein, by the ſwelling of the mucous capſule below it, whence an obſtruction of the blood, and a conſequent dilatation of the coats of the vein. Diſeaſes.

When the enlargement of the vein is not conſiderable, it requires no particular attention; but if it ſhould increaſe ſo far as to be troubleſome, methods muſt be taken for its removal. This may be effected, either by producing ſuch a preſſure on the vein as ſhall ſtop the circulation of the blood in it, or by tying up the vein with a ligature. In applying preſſure, ſuch a bandage ſhould be adopted as may ſurround the whole hock, while the greateſt preſſure is made on the dilated vein. Mr Blaine recommends for this purpoſe a bandage including ſeveral of thoſe elaſtic tubes, ladies glove braces or tops are made of, which would occaſion permanent preſſure, and yet permit motion. But, ſhould it ſtill be found to reſiſt this, its removal muſt be attempted. For this purpoſe, an opening ſhould be made above the enlargement, and then including the vein within a ligature, and an opening below likewiſe, including the vein alſo at that part; the enlarged part may then be puncture, to let out the diſtending blood, and the remainder ſuffered to ſlough away *.

* *Blaine's Outlines*, vol. ii.

CHAP. VI. *Morbid Affections of Reſpiration.*

434 In many complaints, eſpecially fevers and inflammations of the internal organs, the breathing becomes hurried, and inſpiration and expiration, but eſpecially the former, are performed more quickly than in the healthy ſtate of the body. This hurried reſpiration, in the inferior animals, is known by the rapid heaving of their flanks; and when it is attended with conſiderable heat and dryneſs of the ſkin, it denotes conſiderable danger. Any particular conſideration of this ſymptom will, however, be more proper, when we come to treat of the particular caſes in which it occurs.

The principal affections of breathing which we ſhall here notice, are thoſe in which reſpiration is rendered difficult, without being attended with fever or inflammation. Horſes are more liable than other domeſtic animals to difficulty of breathing, and one particular modification of it, *broken wind*, is peculiar to this animal.

435 Snores, or ſnivels. There ſometimes takes place within the noſtrils a gathering of thick clotted matter, which, when it comes to any conſiderable height, very much obſtructs reſpiration, and produces a ſnivelling noiſe when the air paſſes through the noſtrils. This affection is called the *ſnores*, or *ſnivels*, and is almoſt peculiar to cattle. It is ſometimes miſtaken for a diſorder of the throat, where it is imagined there is ſome obſtruction; but when this rattling noiſe is found to attend the breathing of cattle, it may generally be diſcovered whether or not it be the diſeaſe in queſtion, by a careful inſpection of the noſtrils. The ſwelling thus produced in the noſtrils generally goes on to ſuppuration, and when it breaks the animal is relieved. The object of our treatment muſt therefore be to haſten the ſuppuration by the application of warm ſtimulating fomentations or liniments. A very common application in theſe caſes is the oil of bays injected up into the noſtrils; but perhaps the ſteam of warm water would anſwer every good purpoſe, and might be eaſily applied, by putting a warm bran maſh into a canvas bag, and tying it to the animal's head; and this may

Diſeaſes. may be repeated till the impoſthume breaks. The animal ſhould in the mean time be kept in a well-ſheltered houſe, and ſhould be fed on nouriſhing diet.

436 Chronic cough. Cough is almoſt a conſtant attendant on colds, conſumptions, inflammation of the lungs, and other pulmonary complaints; and when it occurs as a ſymptom of theſe diſeaſes, no particular attention is to be paid to it, as our principal object is the primary affection. It frequently happens, however, that after the inflammatory affection is removed, an obſtinate cough remains; and if this is attended with no conſiderable difficulty of breathing, and if the horſe eats well, and appears thriving, the cough alone requires our attention. This kind of chronic cough is generally more conſiderable in the mornings and evenings, and after eating, and is generally increaſed by any violent exertion.

Chronic coughs, though generally a conſequence of previous inflammation, may ariſe from a peculiar irritable ſtate of the top of the wind-pipe; and if this be the caſe, the uſe of ſome narcotic ſubſtance, as opium or hemlock, may be proper. A very obſtinate cough is often the conſequence of preceding inflammation, and is attended with a peculiar noiſe, as if the aperture through which the air came was diminiſhed. This kind of noiſe is called *roaring*, and it is found on diſſection that the wind-pipe is contracted by a quantity of coagulable lymph, that has been effuſed during the inflammation. Mr Blaine has ſeen a preparation where the diameter of the wind-pipe was reduced to one-third of its original dimenſions, and it has often ſtruck him as not improbable that the graſping the wind-pipe hard, as is ſometimes done to try the wind, may bring on inflammation, and occaſion this affection.

Theſe chronic coughs, eſpecially the *roarer*, ſcarcely admit of a complete cure; but they may in general be mitigated, by keeping the animal warm, and by avoiding violent exertion. The food ſhould be ſuch as is eaſy of digeſtion, and does not produce much diſtenſion of the ſtomach. Tar is much recommended in theſe caſes, eſpecially for the cough, or *hooſe*, that ſometimes occurs in cows. An ounce of tar, with the ſame quantity of vinegar of ſquills, and a little oil of aniſeed is to be given every morning, in a quart or chopin of warm ale.

437 Broken wind. One of the moſt common defects in a horſe's breathing is that which is called *broken wind;* the nature of which complaint has been of late much elucidated by Mr Coleman. According to Mr Lawrence, broken wind is diſcovered by the quick and irregular heaving of the flanks, and a more than ordinary dilatation of the noſtrils; ſometimes alſo, by a conſumptive appearance of the body. But the uſual method of trying the ſoundneſs of a horſe's wind, is to cough him; which is performed by preſſing the upper part of the wind-pipe with the finger and thumb. The ſtrong, clear, and full tone of the cough, prove his wind to be ſound; if, on the contrary, the note be ſhort, whiſtling, and huſky, the horſe is aſthmatic and unſound. Horſes labouring under the worſt ſtage of this diſeaſe, are ſtyled, in the language of the repoſitory, *roarers*; from the noiſe they make in work, of very little of which they are capable. Broken-winded mares are generally barren, although we have heard of one which bred a whole team of horſes after ſhe became ſo. In confirmed broken wind there is ſometimes obſerved a palpitation of the cheſt, with conſtant contraction and dilatation, and now and then a conſiderable cavity or depreſſion may be perceived. Diſeaſes.

The older writers had many ſtrange opinions with reſpect to the nature of this complaint. Gibſon attributed it to an enlargement of the contents of the cheſt, and Dr Lower thought it proceeded from a rupture of the phrenic nerve. A friend of Bartlet ſuppoſed the diſeaſe to proceed from a morbid or obſtructed ſtate of the glands and membranes of the head and throat, the enlargement of which prevented a free paſſage to the wind. According to Mr Oſmer certain glands, which are placed upon the air-pipe, at its entrance into the lungs, are become enlarged, and thereby the diameter of the tube is leſſened; hence the received air cannot ſo readily make its eſcape, nor reſpiration be performed, with ſuch facility as before; from which quantity of contained air the lobes of the lungs are always enlarged, as may be ſeen by examining the dead carcaſes of broken-winded horſes.

It is now ſatisfactorily aſcertained, that the immediate cauſe of broken-wind is a rupture of ſome of the air-cells of the lungs. The cauſe that moſt commonly produces ſuch a rupture is over diſtenſion of the ſtomach, attended with hard and violent exertion. The horſe being an animal that is always eating, will, when hungry, eat very voraciouſly, if he has an opportunity, and ſoon fills his ſtomach; and if, in this ſtate, he is exerciſed violently, the circulation and reſpiration will be increaſed, but the lungs cannot expand ſufficiently, becauſe the diaphragm cannot deſcend from the preſſure of the ſtomach. In this caſe, the circulation being hurried, the lungs do not undergo the neceſſary change, in conſequence of their now being compreſſed. The animal then, endeavouring to take in more air, either actually occaſions the cells to be ruptured, or ſomething elſe to give way. If the cells are ruptured, the air eſcapes from them into the cellular membrane of the lungs, and there acts as foreign matter, or, at leaſt, it cannot then produce the neceſſary change on the blood, when thus diffuſed; in conſequence, difficulty of breathing ariſes from two cauſes: 1ſt, From the blood paſſing through the lungs before it has undergone its neceſſary alteration; and, 2dly, from the rupture of the air-veſſels. The reſpiration is rendered ſlow, as is ſeen by the flanks being long in riſing up, becauſe there is no direct communication with the bronchia, as in the healthy ſtate of the lungs; inſpiration is, however, in a third of the time of expiration, which is ſeen by the ſudden deſcent of the flank. The lungs, from containing more air, are ſpecifically lighter than in the healthy ſtate.

This local diſeaſe does not admit of a permanent cure, at leaſt no medicine has yet had any ſuch effect; but a temporary relief may be obtained, as we ſhall ſee hereafter. But we muſt not omit to mention here a moſt ridiculous practice which has ſometimes been tried by common farriers, that of making an orifice above the rectum, and then introducing a machine ſimilar to a muſical inſtrument called a *flageolet*, with the idea of evacuating the ſuperfluous air, or wind, which they ſuppoſe to have produced the diſeaſe.

Bliſtering the wind-pipe, rowelling the cheſt, and a ſmall purgative of aloes and calomel now and then, have often produced a good effect.

A pound or two of ſhot has been ſtrongly recommended to Mr Coleman, as a ſpecific; but, upon trial, it has been

Diſeaſes. been found to have no obvious effect: it was thought that the ſhot would act by its ſpecific gravity inclining the ſtomach further back into the cavity of the abdomen.

The treatment muſt be nearly confined to diet and exerciſe; the animal ſhould have little hay, and water in particular muſt be adminiſtered with a very ſparing hand. Thoſe ſubſtances which afford moſt nouriſhment in the leaſt compaſs, as carrots, corn, ſplit beans, &c. ſhould be given; the horſe ſhould always be worked upon an empty ſtomach; and, upon the whole, his diet ſhould be ſmall in quantity, but nouriſhing. By obſerving this method, a broken-winded horſe may do a great deal of work, and be uſeful to the owner. *

* *Feron's Farriery.*

According to Mr Blaine, internal medicines have ſometimes been found uſeful in this complaint. Lime-water has been employed with advantage; and the uſe of tar is much recommended. Mr Blaine preſcribes a mixture compoſed of two gallons of lime-water, four pounds of tar, and an ounce of freſh bruiſed ſquills, or garlic, of which an Engliſh pint (or mutchkin) is to be adminiſtered every morning.

A complaint ſimilar to the foregoing often occurs in the horſe, and is called *thick wind*. It proceeds from a very different cauſe, being always the cauſe of previous inflammation, during which coagulable lymph has been effuſed, as in the *roarer*. Thick wind may be diſtinguiſhed from broken-wind, by the inſpirations and expirations being equal in the former; while in the latter the reſpiration is not ſo frequent, and the principal difficulty conſiſts in expiration, which is of courſe performed in longer time than inſpiration.

438 Thick wind.

Little can be done towards a cure of this complaint. We may prevent the diſeaſe by good management in the adminiſtration of the aliments, exerciſe, &c. Calomel has been employed to produce abſorption, but without any great effect; a rowel under the jaw, and frequent applications of bliſters on the windpipe, are the only methods capable of producing abſorption of the lymph. Half a drachm of the digitalis, or fox-glove, in powder, twice a day, makes an admirable remedy in this, and local diſeaſes of the lungs.

439 The breathing may be completely obſtructed, either by the want of a regular ſupply of freſh air, or by the animals being obliged to breathe ſuch kinds of air, as are unfit for reſpiration. The conſequence of this impeded breathing, is a ſuſpenſion of the vital powers, or, if the obſtruction continues long, death will ſometimes be produced. As ſuſpended animation is always attended with more or leſs of an apoplectic ſtate, we ſhall defer the conſideration of thoſe caſes till we come to treat of comatous diſeaſes.

Chap. VII. *Morbid Affections of Secretion and Excretion.*

440 The fluids that are ſecreted, or ſeparated from the general maſs of blood, by means of the organs called glands, are in ſome caſes ſecreted in an unuſual quantity, in others their ſecretion is leſſened, or their excretion or paſſage out of the body is obſtructed. Thus in colds of the head, as they are called, in glanders, and in ſome other affections, an unuſual running takes place from the noſe; in inflammation of the eyes the ſecretion of tears is generally increaſed, ſometimes diminiſhed, while it ſometimes happens that their paſſage from the lachrymal gland out of the eye is obſtructed. Again the ſecreted fluids may undergo various changes in their colour, fluidity, and compoſition. Thus the urine is ſometimes yellow, at others red, or blackiſh; it is ſometimes extremely watery, at others very thick and muddy, and in one particular diſeaſe, the *diabetes*, it ſeems to loſe altogether the properties of urine, and appears like a ſolution of ſugar, or honey. Diſeaſes.

In the preſent chapter, we ſhall conſider the morbid affections of the bile, and of the urine. We ſhall alſo make ſome obſervations on coſtiveneſs and purging.

441 Jaundice or yellows.

The principal morbid affection of the biliary ſyſtem that takes place in the inferior animals, is the obſtruction to the paſſage of the bile, from the liver into the bowels, producing the diſeaſe called *jaundice* in the human body, and commonly known to farriers and cattle-doctors, by the name of the *yellows*.

This diſeaſe ſeldom takes place in the horſe, for as it is almoſt always the conſequence of biliary concretions, or gall-ſtones formed within the gall bladder, and as this animal has no gall bladder, the diſeaſe in queſtion can ſeldom take place. It may however happen that an obſtruction may take place in the common duct or pipe, that conveys the bile from the liver, either from concretions formed in the duct, from a ſpaſmodic contraction of the duct, or from a ſchirrous or hardened ſtate of the liver. The diſeaſe is however ſufficiently common in cattle and ſheep; and a deſcription of the ſymptoms that mark the complaint in theſe animals will almoſt equally apply to the diſeaſe when it may take place in horſes. According to Mr Denny, young horſes are very ſubject to a variety of jaundice.

Its firſt viſible ſign is a yelloviſh tinge in the white part of the eyes, mouth, and tongue; the mucus and ſaliva, from the noſtrils and mouth, are of a greeniſh hue, bordering a little upon the yellow. The beaſt is dull, and heavy, loathing all kinds of food, eating no more than a bare ſufficiency for the ſupport of nature; the ſkin is dry and itchy, eſpecially behind the ſhoulders, where it can ſcarcely bear the touch. The beaſts have an utter averſion to exerciſe, or ſtirring from the place where they are, and if removed with the leaſt degree of precipitation, will break into a cold ſweat. Their urine is of a deeper yellow than uſual, which has ſometimes led to believe it was red water, or bloody urine. The dung undergoes a very conſiderable alteration in all ſtages of the diſeaſe, and its general colour is blueiſh or brown, and much reſembling burnt clay; but it varies in colour according to the ſubject, or different circumſtances and ſeaſons. If the diſeaſe continues long the beaſt gradually pines away, and at laſt dies of a decline.

It is ſaid that horſes have ſometimes died of jaundice, in two or three days; and in theſe violent caſes a black ſanious diſcharge has taken place from the mouth and noſtrils a little before death. This is called by farriers the black jaundice, and after death the liver is found totally decayed. Mr Lawrence ſays that he has repeatedly ſeen caſes of this kind. Gibſon ſpeaks of an inflammatory ſpecies of jaundice, attended with delirium and madneſs; but this was probably a violent inflammation of the liver.

We have ſaid that the immediate cauſe of this diſeaſe is an obſtruction of the gall pipe, commonly owing

Diſeaſes. to the formation of gall-ſtones. The formation of theſe concretions is moſt likely to take place, when the animals are deprived of their regular exerciſe, and are at the ſame time allowed too full a diet, or are given food of an improper quality. It is ſaid to be very common in ſome of the cold provinces on the continent, where the cattle are ſtall fed during the winter; after which the moſt of them are attacked with it in the ſpring. It may ſometimes be brought on by hard labour and poor living; but then it probably depends on a diſeaſed ſtate of the liver.

In the treatment of jaundice, our chief reliance is to be placed on the uſe of purgative medicines; and of theſe rhubarb, calomel, and aloes, ſeem to be the moſt proper; and during their exhibition, gentle exerciſe ſhould be employed. Mr Denny ſays that much relief is often afforded in the jaundice of young horſes, by giving a ball compoſed of an ounce of aloes, half an ounce of Venetian ſoap, and a drachm of calomel; every ſecond or third night, and giving on the intervening mornings a ball of half an ounce of nitre, with the ſame quantity of powdered roſin, and of common ſoap. Maſhes and warm water are to be given plentifully, and the horſe muſt be kept warm by clothing, and fully exerciſed.

In cattle, a vomit of emetic tartar may be tried at the firſt appearance of the diſeaſe, as the effort of vomiting may aſſiſt in promoting the paſſage of the gall-ſtone. If, however, the diſeaſe ſhould ariſe in conſequence of previous inflammation of the liver, vomits will be of no uſe, and the beſt remedies will be mercurial purgatives with ſoap. The food ſhould conſiſt of ſucculent and watery ſubſtances, eſpecially of freſh graſs; as it is found that when cattle affected with this diſeaſe are ſent to paſture they commonly ſoon recover. Warm maſhes of bran or malt ſhould be given frequently, both to obviate coſtiveneſs, and as being good articles of diet. If the diſeaſe ſhould continue obſtinate, and the uſe of mercurial medicines ſhould be found neceſſary, the animal muſt be confined within doors, during night and bad weather; and a horſe ſhould during the exhibition of the medicines be covered with a ſingle cloth. It will be proper, whenever the weather and other circumſtances permit, to give the animal regular exerciſe in the open air; but if neceſſity obliges us to keep him within doors, the whole body, but eſpecially the belly, ſhould be well rubbed for a conſiderable time, twice or thrice a day. This friction will be proper, even though regular exerciſe can be taken in the open air.

442 Horſes, and ſometimes cattle, are ſubject to a profuſe diſcharge of urine; but as the complaint of which this is a principal ſymptom, ſeems not to be ſeated in the urinary organs, we ſhall not conſider it here, but ſhall treat of it among the general and more important diſeaſes.

443 Incontinence of urine. It often happens that there is an inability in theſe animals to retain their urine for any length of time; they are either obliged to void it very frequently, and in ſmall quantities, or, what is more frequent, it drops away imperceptibly and involuntarily, forming the complaint called *incontinence of urine*. This complaint differs from diabetes, or profuſe ſtaling, in the urine coming away by drops, or in very ſmall quantities at a time, whereas in diabetes it paſſes off in a full and copious ſtream. Diſeaſes.

Incontinence of urine is extremely common to dogs, and often ariſes in theſe animals from exceſſive venery, or from the violent efforts which they are ſometimes, by the brutality of byſtanders, obliged to make to ſeparate themſelves from the females. It is alſo not uncommonly owing to the preſence of a ſtone in the bladder. M. Barruel, profeſſor of the veterinary ſchool of Alfort, had a little Spaniſh bitch, not above five inches high, and about ſeven years old, who was troubled with an incontinence of urine, unaccompanied by any other ſymptom; ſhe was ſprightly and well, and was in good condition. Not knowing to what to attribute the complaint, M. Barruel tried a number of remedies, ſuch as warm bathing and clyſters of various kinds, but without effect; at laſt he killed the bitch, and found in her bladder a ſtone that weighed an ounce and 40 grains, a very conſiderable bulk, if we advert to the ſmall ſize of the animal.

This complaint is leſs common in the horſe, but it may ariſe in any of theſe animals from a paralytic affection of the ſphincter muſcle at the neck of the bladder; which is ſometimes the conſequence of the bladder's being unuſually diſtended with urine. When there is reaſon to ſuppoſe that it is owing to this cauſe, the beſt remedy is a bliſter applied above the pubis, or the frequent application of ſtimulating liniments to the ſame part.

444 Suppreſſion of urine. A difficulty of making water, or even an entire ſuppreſſion of urine, is a very common diſeaſe among horſes, and frequently occurs in ſheep. The ſymptoms accompanying this affection, differ ſomewhat according to the cauſes which have produced it; we ſhall therefore conſider it under ſeveral heads.

445 Cauſe from over diſtenſion of the bladder. 1. One of the moſt common cauſes of a ſuppreſſion of urine, is ſuffering the animal to travel for a long time without ſtopping him to allow him to ſtale; a circumſtance which is often neglected by thoughtleſs people, while on a journey. From the urine being ſo long retained, the bladder becomes exceſſively diſtended; conſiderable irritation takes place, and when the diſtenſion has proceeded to a great height, the animal, though conſtantly ſtimulated to relieve nature, is not able to effect his purpoſe, owing to a paralytic affection that has taken place in the muſcular coat of the body of the bladder, attended probably with a ſpaſmodic contraction of the ſphincter. If the animal be not ſoon relieved, a conſiderable ſwelling appears above the pubis, accompanied with great uneaſineſs; the urine becomes abſorbed, and is carried through the circulation to various parts of the body, producing an itching of the ſkin, and generally, in no long time, apoplexy and death.

Sometimes, however, before any conſiderable abſorption can take place, the bladder either becomes inflamed, or burſts, and diſcharges its contents into the belly, producing there inflammation and mortification.

446 Watery braxy. This complaint is, as we have ſaid, very common among ſheep, conſtituting an affection which in Scotland is called the *watery braxy*. It is ſaid that young and vigorous ſheep are moſt liable to it; and according to the writers of the ingenious appendix to Mr Findlater's ſurvey, the immediate cauſe of the diſeaſe, is feeding too freely on ſucculent diuretic food, and reſting too long

Diſeaſes. long in their laires in the morning. It has been frequently obſerved, that this ſpecies of braxy is moſt apt to make its attacks upon Sundays, becauſe ſhepherds generally ſleep longer on Sunday mornings than other days of the week, and, of courſe, allow the ſheep to remain too long in their laires. This diſeaſe may be prevented by avoiding too free a uſe of ſucculent diuretic food, and by moving the animals from their laires early in the morning, making them walk about for ſome time, in order to encourage them to paſs their urine and purl.

In attempting to effect a cure, it may be known whether the bladder is affected, by a great fulneſs in the lower part of the belly, immediately above the pubis. The ſeat of the diſtemper being aſcertained, a female ſilver catheter, or one of elaſtic gum, ought inſtantly to be paſſed through the urethra into the bladder of females. This will draw off the urine, and give immediate relief. But this will be attended with greater difficulty in males; and if attempted, muſt be done with a long and properly bent catheter or bougie. In either caſe, when this cannot be accompliſhed, a puncture may be made into the bladder with a trocar, directly above the pubis; taking care not to wound the inteſtines. By either of theſe methods, the urine may be diſcharged, and the animal relieved. In other reſpects, with a view to allay or prevent inflammation, evacuations ſhould be procured by clyſters and warm injections into the great gut.

447 From inflammation

2. In the caſe which we have been conſidering, the urine, though ſecreted as uſual, could not be diſcharged; but a ſuppreſſion of urine ſometimes takes place from the ſecretion not going on as uſual, owing to ſome affection of the kidneys, commonly an inflammation of thoſe organs. We can ſcarcely with propriety conſider this caſe here, but ſhall treat of it among the other inflammations in the ſecond chapter of the next ſection.

448 Stone.

3. Another cauſe that may produce a ſuppreſſion of urine, or a difficulty in ſtaling, is a ſtone in the bladder, or gravelly concretions paſſing from the kidneys through the ureters or urinary pipes. We have juſt ſeen that a ſtone is ſometimes found in the bladder of dogs; but doubts have ariſen, whether this could take place in the horſe. Examples of it are no doubt very rare, but we have ſufficient proof that it may take place. Mr Clark of Edinburgh mentions that he has ſeveral ſtones taken out of different horſes; and it is ſaid that Dr Mead had in his cabinet one that weighed 11 ounces. M. Huzard gives an account of a diſſection that he made of a horſe that died of a ſuppreſſion of urine, in whom the following appearances were obſerved. The bladder contained a conſiderable quantity of red and bloody urine. Its internal membrane was thickened, eſpecially at its lower part; and it was alſo inflamed and gangrenous in ſeveral points. The ureter contained at about its middle, a fragment of a ſtone that entirely blocked up the paſſage of the urine, and had no doubt been the cauſe of this ſuppreſſion. The ſtone was imbedded in a cavernous body like the kernel of a fruit. *Within the bladder there was alſo a ſtone about the ſize of a large pullet's egg, broken into two portions.*

If we conſider that ſymptoms of gravel are by no means uncommon in the horſe, that gravel is often found in his urine, and that calculous concretions have been frequently obſerved in his kidneys, we ſhall eaſily ſee that theſe caſes are not ſo extraordinary as ſome may imagine. There is no doubt, however, that caſes of a ſtone in the bladder cannot ſo frequently happen in quadrupeds, from their horizontal poſition, which prevents the ſtone from paſſing from the kidney into the bladder ſo readily as in the human ſubject. Hence the kidneys have often been found to contain ſtones of a conſiderable ſize, without the horſe having been during life affected with ſymptoms of calculus. Diſeaſes.

When concretions form in the kidneys, they generally produce a great degree of irritation, and conſequent inflammation; but if a horſe is affected with a ſuppreſſion of urine, there is reaſon to ſuppoſe that a ſtone is lodged in the bladder. The certainty of this having taken place may be very readily aſcertained, by introducing the hand within the rectum, as the ſtone will, for the moſt part, be felt below the finger.

It is not probable that internal remedies can have any effect in caſes of calculus in the horſe. In the beginning of the complaint, when the ſymptoms are very ſlight, diuretic medicines may be tried, and will perhaps bring away the ſmall ſandy particles; but if a ſtone of any conſiderable ſize be lodged in the kidneys, the caſe is incurable. If the ſtone has got into the bladder, it may be extracted by making a cut into the bladder above the pubis, and taking out the ſtone by means of forceps, ſuch as are employed by ſurgeons in the operation for the ſtone. In the mean time the animal may be relieved, by drawing off the urine from time to time by means of a catheter, which is eaſily uſed in the mare, and by preventing coſtiveneſs. Too much labour or over exertion ſhould alſo be avoided, and the animal ſhould live chiefly on ſucculent food.

449 Obſtruction at the neck of the bladder.

4. A ſuppreſſion of urine may ariſe from an obſtruction in or about the neck of the bladder. A curious caſe of this kind occurred to M. Huzard, and he has related the appearances on diſſection, which were as follows.

There was at the baſe of the ſpermatic arteries, on the right ſide, a glandulous body about the bigneſs of one's fiſt, through which oozed a lymphatic fluid, that was whitiſh and thick, in ſome places appearing like pus. The bladder was enormouſly diſtended with urine, and extended into the belly beyond its uſual limits; it was inflamed and thickened; the urine was nearly in its natural ſtate. The neck of the bladder was filled with varicoſe excreſcences, that completely obſtructed the paſſage. Theſe excreſcences were red, and ſo hard as to reſiſt the knife; they contained each a ſmall particle of hardened blood, in which two parts were diſtinguiſhable. The bottom of the bladder was very black, and its ſurface of a reddiſh yellow; the whole of the urethra was red and inflamed.

450 Bloody urine, or red water.

It will be pretty evident, that, ſhould a caſe like this occur, it is incurable. It ſometimes happens that the urine appears unuſually red, as if bloody. This affection may take place in any of theſe animals, and it is called *bloody urine*, *piſſing of blood*, or *red water*. It is moſt common among cattle. It may ariſe from falls or bruiſes, from overſtraining at hard work, as in horſes from a hard run heat in racing, or after any violent exertion, ſuch as a deſperate leap; or it may proceed from inflammation of the kidneys.

When it takes place in cattle, the animals are affected with an almoſt inceſſant deſire to ſtale; ſometimes they

Diſeaſes. they make but little water at once; ſometimes the urine comes away in its uſual quantity. In this latter caſe, if the urine be deeply tinged, it is conſidered as a very dangerous ſymptom, and when it happens, the beaſts leave the herd, and appear to feel conſiderable pain; they hold up their tail, and ſometimes hold their back higher than common. In fact, theſe ſymptoms, which do not ſeem well underſtood by the cattle doctors, indicate an inflammation of the kidneys.

When this diſeaſe is occaſioned by ſtrains, bruiſes, or any violent exertion, there is reaſon to fear that inflammation may take place. This muſt therefore be guarded againſt by bleeding, cooling drinks, and ſucculent food; by avoiding exerciſe and every thing that can heat or irritate. It is a common cuſtom to give nitre and other ſaline ſubſtances in theſe caſes; but when there is any inflammatory affection in the kidneys, theſe ſalts are improper, as they tend to increaſe the irritation of theſe organs. The beſt drinks in ſuch caſes will therefore be thin gruel, linſeed-tea, or bran-water.

Cattle are ſaid to be moſt ſubject to the red water in the ſpring, or ſummer, while at graſs; and it is ſuppoſed to be produced ſometimes by ſudden changes of the weather, by want of water, or the uſe of ſuch as is unwholeſome. Young cattle are more ſubject to it than thoſe of more advanced age; hence particular attention ſhould be paid to theſe young animals; as when the affection has once taken place, it is conſidered as highly dangerous. Theſe are the opinions of cattle doctors, and we ſuppoſe they refer chiefly to inflammation of the kidneys, of which bloody urine is, as we have ſaid, a prevalent ſymptom. This formidable diſeaſe will be conſidered more at large hereafter.

It appears that when cattle are ſent from Europe, to the Weſt Indies, the bulls when firſt put on ſhore are extremely liable to this complaint, which often proves fatal. It is attributed to the eager deſire which theſe animals, after having been ſo long confined to a dry diet on board, have for green ſucculent food, in which they will of courſe indulge to exceſs the firſt opportunity. The remedies found moſt effectual are bleeding, and the adminiſtering of nitre and purging ſalts; but it might probably be prevented by houſing the cattle immediately after they are brought on ſhore, and accuſtoming them gradually to their change of diet.

451 Black water. Sometimes the colour of the urine in ſheep and cattle is nearly black, and they are then ſaid to labour under the black water. This affection is not well underſtood, but it is probably a variety of the laſt. It is ſaid to be produced by feeding on cold, wet land, and that ſimple removal of the cattle to a more favourable ſituation will often effect a cure. Mr Lawrence conſiders the black water as a ſymptom of incipient mortification of the kidneys, and commends bleeding, (unleſs in a cow), cordials and tonics, ſuch as iron filings, with bark, opium, nitre, in ſtrong beer, if the progreſs of mortification be apprehended. We may remark, that, if mortification of the kidneys has taken place, which may in general be known by the ſtinking ſmell of the urine; all theſe remedies could produce no effect; and it would be much better to kill the animal it once, than be at the expence of time, labour and medicines, in attempting to effect a hopeleſs cure.

452 Scouring or purging in horſes. A ſcouring or purging is a very common diſeaſe in all our domeſtic animals; and in ſome of them it is very dangerous, and very difficult to cure. The complaint is ſomewhat different in the ſeveral ſpecies, ſo as to require a particular deſcription in each. Some horſes are liable to be affected with a purging from the ſlighteſt cauſes, and on every exertion. Theſe horſes are called by grooms *waſhy horſes*, and they are ſaid to have narrower cheſts and lanker bellies than others; and it is to this unuſual deformity that the purging is generally attributed. Some horſes are ſaid to labour under a nervous diarrhœa; thoſe that are chiefly ſubject to it are young, and of a weak and irritable habit. The complaint generally appears on them only when at work; and when they are ſuffered to remain idle, their bowels are ſufficiently healthy. Mr Lawrence had a favourite young horſe that was ſubject to this nervous ſcouring, and on whom he tried a variety of medicines to no purpoſe, as it was found that nothing but idleneſs could arreſt the complaint. To uſe Mr Lawrence's words, "the nag whilſt at play, was always fat as bacon, and very firm in body; but a week's work reduced his fleſh, and cauſed him to dung like a cow." Horſes of this delicate conſtitution require great care and attention, or they will not be of much uſe to the owner. They ſhould have ſtrong nouriſhment, but it ſhould be given in ſmall quantities at a time. Mr Lawrence recommends good old beans mixed with their oats, lucerne, or ſtrong upland hay, with rice mathes, carrots, and occaſional runs of graſs.

Diſeaſes.

A purging may be brought on in horſes by a ſudden change of diet, as from hay to graſs, or from graſs to hay. Hence, in ſuch horſes as are liable to diſorders of the bowels, theſe changes ſhould always be made very gradually. It is very commonly the effect of expoſure to cold while the body is heated, and is one of the leaſt dangerous affections ariſing from that cauſe. A purging may alſo be owing to irritating ſubſtances, ſuch as crude, unwholeſome, or undigeſted food remaining in the bowels; and in theſe caſes it is often attended with pain, from the formation of an acid in the bowels.

A purging in horſes is ſeldom dangerous, except when it ariſes to a great height, or continues very long, ſo as to produce a great waſte of fleſh, or very conſiderable weakneſs.

In general it is ſufficient, in order to carry off a purging in horſes, to avoid the cauſes which have produced it, where theſe can be aſcertained; to waſh away irritating ſubſtances from the bowels, by giving plentifully of diluting liquors, ſuch as water gruel and linſeed tea, or gradually to change the diet, if the purging ſeems to have ariſen from improper feeding. If, however, the diſeaſe ſhould continue obſtinate, or be attended with unpleaſant ſymptoms, means muſt be taken for checking or removing it. Some caution is requiſite as to the plan of treatment to be adopted; as, if the complaint be checked too ſuddenly, ſome other dangerous affection might be produced. Veterinary writers differ conſiderably with reſpect to the treatment of diarrhœa in horſes; ſome recommending gentle laxatives, as rhubarb, which Mr Lawrence conſiders as the ſheet anchor in theſe caſes; while others as ſtrenuouſly adviſe againſt the uſe of purgatives, and recommend opium and aſtringents. Probably in moſt caſes there is little need of laxatives, and after plentiful diluting, one of the beſt remedies will be clyſters of ſtarch or water gruel, with a ſmall quantity of laudanum. If there is acidity in the

Diſeaſes. ſtomach and bowels, prepared chalk or lime water may be given with advantage; and if there is conſiderable weakneſs, the ſtrengthening aſtringent medicines may, in the latter ſtages, be uſed without heſitation. We agree with Mr Blaine, that theſe are leſs proper at the commencement of the diſeaſe.

453 In cattle. In cattle this complaint is ſometimes very ſerious, and farmers not unfrequently loſe ſeveral of theſe animals by it in a ſeaſon. This has induced them to call it the *ſcouring rot*. When the purging has continued long, it produces in theſe animals a general weakneſs and loſs of fleſh. Their ſkin ſometimes hangs looſe about the body; in other caſes they appear hide-bound; the hair turns ſandy, or of a grayiſh colour; their eyes grow pale; the pulſe becomes weak and irregular; their excrements thin and ſlimy, and frequently change colour, eſpecially in the early ſtages of the diſeaſe; but when the complaint is pretty far advanced, the dung appears like half-chewed food; and in fact, in theſe caſes the food appears to paſs through the bowels without undergoing the digeſtive proceſs. It is ſaid that when the animals have been long affected with this ſcouring rot, they feel a great degree of diſtreſs and pain, when graſped on each ſide of the back-bone, juſt behind the ſhoulders; and this is conſidered as a ſure mark that the beaſt has become tainted or unſound, from the ſcouring rot.

This complaint in cattle may ariſe from moſt of the cauſes that have been ſtated to produce it in the horſe; but it is conſidered as being moſt commonly owing to their being overheated in driving, and to want of ſufficient nouriſhment, either with reſpect to quantity or quality. It may be produced in cows, by their being conſtantly and too frequently milked, while they are deprived of proper nouriſhment; and it is not uncommonly produced by lodging on wet ground in autumn, and feeding on a coarſe, unwholeſome fog.

In the treatment of this complaint in cattle, a number of ſtrange remedies have been employed, ſuch as hogs dung, turpentine and butter-milk; dock root boiled in ſalt and water, and nettle root boiled in forge water. Among the moſt ſenſible receipts that we have ſeen, is one in Rowlin's Cow-Doctor, compoſed of three ounces of bole armoniac, with two ounces of bay berries, and the ſame quantity of alum, of ſhavings of ivory, and powdered comfrey root, boiled in two quarts of ſkimmed milk, adding while boiling a handful of ſtarch. This is to be given for a doſe, for which, however, it is perhaps rather too ſtrong. Mr Lawrence recommends that, on the firſt appearance of the ſcouring, the cattle ſhould be taken to the home fold, and put on dry food, which will generally ſuperſede the neceſſity of medicine. The remedy which Mr Blaine ſeems chiefly to rely on, is a decoction of an ounce of ipecacuanha, a drachm and half of nux vomica, half an ounce of galls, two drachms of alum, and 20 grains of white vitriol, in a quart of water boiled to a pint. Perhaps this decoction is rather too complex, and ſome of its ingredients may be ſpared. The receipt, N° 30. is well ſuited to theſe caſes. It may be ſuppoſed that where the ſcouring has continued for any conſiderable time, the bowels are become extremely ſore and tender. In this caſe, mucilaginous or oily ſubſtances would be of advantage, and they ſhould be given frequently, both by the mouth and by way of clyſter. Mr Lawrence recommends a pound of freſh mutton ſuet boiled in 3 quarts of milk until the ſuet is diſſolved, to form a drink to be given warm. This, we doubt not, will anſwer extremely well. If the diſeaſe ſhould go to an alarming height, ſtarch clyſters with laudanum may be given as a laſt reſource. Mr Blaine remarks, that, in theſe caſes, he ſhould be diſpoſed to try animal food altogether; giving broth to drink, or the blood of other animals, with meat balls forced down the throat; as he thinks it not improbable that thus a change might be effected in the conſtitution, which might pave the way to a cure. Diſeaſes.

Dr Dickſon thinks that much advantage may be derived in theſe caſes, from a ſtrong decoction of hartſhorn ſhavings and caſſia, with powdered chalk, in the proportion of half a pound of chalk, four ounces of ſhavings, and an ounce of caſſia, to be boiled together in two quarts (chopins) of water to three pints, (mutchkins), adding the caſſia towards the cloſe of the boiling. A hornful of this mixture is to be given ſeveral times in the day, ſhaking it well every time.

454 In calves. Calves, when firſt weaned, are ſubject to a ſpecies of purging which ſometimes proves extremely obſtinate; and it is ſaid that the principal reaſon of the calf-feeders giving them chalk to lick, is to prevent this purging. It appears that this diſeaſe will take place in calves, when they are fed on the milk of ſome particular cows; and that when the milk is changed the complaint goes off. The purging may in general be checked by boiling ſtarch and bean flour in their milk; and if it ſtill continues obſtinate, a little ginger and laudanum may be added.

455 Pinning in lambs. This diſeaſe is extremely incident to young lambs, and it is called by the ſhepherds *pinning*, becauſe when the purging has continued for any time, there flows from the fundament a glutinous matter that faſtens or pins down the tail to the hips, and prevents any farther evacuation. When this is obſerved by the ſhepherds, they commonly ſeize the lamb, and after waſhing away the glutinous matter from the tail, ſo as to diſengage it from the hips, they rub the parts with fine earth, or other fine powdery matter, to prevent their ſticking in future. Something of this kind is very proper, but hogs lard, or any other greaſy ſubſtance, would anſwer the purpoſe much better. The diſeaſe is ſaid to be produced by wet and cold in ſpring, together with the ewes eating too greedily of ſoft moiſt graſs. It may be prevented or cured, by removing the flock to heathy or poorer paſtures, that abound with aſtringent or aromatic plants.

Mr Findlater remarks that among lambs fed with their dams, upon the rich improved paſture of Lothian parks, *pinning* never occurs; whence it is probable that it originates from milk concocted from poorer paſture, which gives more curd than cream to the milk, rendering the excrements of the lamb more viſcid. When the mothers have little milk, the lambs are very rarely *pinned*. *Pinning* is therefore conſidered as a favourable ſymptom of the lamb's being well nurſed. It is not conſidered as a diſeaſe in Tweeddale; though, if not redreſſed, it would be productive of diſeaſe. It is conſidered as an accident to be guarded againſt, and which, like other accidents to which ſheep are liable, requires the ſhepherd to be conſtantly walking through his flock. No Tweeddale farmer would, on this account, remove his ewes and lambs to poorer paſture, where the lambs

Diſeaſes. lambs would be worſe nurſed; as he knows, that if the pinned lamb is timeouſly noticed, and relieved by pulling up the tail, all danger is removed.

456 In dogs. Dogs are alſo very ſubject to this complaint, and it may be brought on in theſe animals by any of the cauſes which we have mentioned as producing it in the other ſpecies. In young dogs it is often the effect of worms, and in this caſe the ſtools are ſlimy, greenith, and ſometimes bloody. Common looſeneſs in dogs may be removed by much the ſame remedies as in other animals, as by ipecacuanha, opium, with ſtarch, or arrow root clyſters, and prepared chalk, if there is any acidity in the bowels; but where it proceeds from worms, it cannot be effectually removed till they are expelled.

Purging muſt be carefully diſtinguiſhed from dyſentery, or what is called bloody-flux in the human ſpecies, and *brake-ſhaw* in ſheep, as in this latter there are ſymptoms of inflammation, and commonly more or leſs of fever. The diſtinguiſhing marks of this diſeaſe will be conſidered hereafter, as we cannot properly treat of it in this place.

457 Coſtiveneſs. Coſtiveneſs, or binding of the belly, occurs occaſionally in all theſe animals; but it chiefly calls for attention in the horſe, as in him it is more frequent and more dangerous. It ariſes for the moſt part from want of exerciſe, when the horſe is kept upon hard dry food, as oats or beans. It is a conſtant ſymptom of colic and of inflammation in the bowels, and the continuance of it always aggravates theſe complaints, and ſeldom fails to produce them where they were not before preſent.

It is beſt prevented by occaſional change of diet; by giving the horſe barley boiled, or green food now and then, where he cannot be frequently ſent to paſture; and every night or two allowing him a maſh of bran, or, if he is of a very coſtive habit, of malt. Regular exerciſe and good dreſſing, eſpecially friction on the belly ſome time after feeding, are alſo good preventives. If it ſhould ariſe to any conſiderable height, the bowels muſt be emptied by back-raking, and the adminiſtration of ſoftening, laxative clyſters, which may be repeated every three or four hours till the bowels become ſufficiently regular. Purges given by the mouth, though they may, after ſome hours, remove the coſtiveneſs, ſeldom fail to do more harm than good, eſpecially if the complaint has continued long; and there is conſiderable heat of the body, fulneſs of the pulſe, pain in the bowels, or great irritation. In theſe caſes, while the bowels are opened by clyſters, it may be proper to take away a little blood.

Suckling calves are ſometimes ſubject to coſtiveneſs. When this happens, the chalk ſhould be taken away, and half an ounce or an ounce of magneſia be given them in a pint of warm gruel; or if the coſtiveneſs continue, a little rhubarb may be added.

Chap. VIII. *Morbid Affections of Generation.*

458 It has been wiſely ordained by nature, that the inferior animals ſhall feel the paſſion of deſire only at certain ſeaſons; and theſe periods are generally ſo adapted, that delivery ſhall take place at ſuch a time of the year as will be beſt ſuited to the rearing and feeding of the young animal. It is probable that in a ſtate of nature theſe animals, whether male or female, do not experience inordinate deſire, except at the proper period; and when domeſticated, the females are ſcarcely ever lalacious, except at theſe times. The males of theſe animals, however, in the domeſtic ſtate, eſpecially dogs, are occaſionally ſubject to exceſſive luſt, and all of them, during the periods aſſigned by nature, become ſometimes very unruly, if not permitted to indulge their natural appetite. Should circumſtances render it neceſſary to prevent them from indulging this propenſity, they muſt be kept on a lower diet than uſual, or have ſuch food as contains leaſt nouriſhment in the ſame quantity; and muſt be made to uſe more exerciſe than common. They muſt alſo be kept extremely cool, and horſes ſhould at theſe times have leſs litter to ſleep on than uſual. Diſeaſes.

459 Indifference. It is of conſiderable conſequence to thoſe who make breeding an object, that the animals who are to copulate ſhould not be indifferent to the act in which they are to engage. It ſometimes happens that either the male or the female betrays a coolneſs or indifference, which may defeat the object of the breeder. When it appears that a ſtallion or a bull regards the mare or cow preſented to him with tranquil air, or turns from her when he ought to do his duty, it is clear that ſomething is wrong, and that the iſſue of ſuch a forced connection would ſcarcely be worth the trouble of rearing. It is ſaid that Spaniſh ſtallions are more ſubject to this indifference than others.

If an indifference of this kind ſhould take place in an animal that is generally keen and vigorous, it would be wrong to employ any incitement to ſtimulate him to an action for which he has perhaps been unfitted by too much exertion of the ſame kind during the ſeaſon; but where the animal is naturally thus cool, and has otherwiſe the requiſite qualities of a good ſtallion or bull, it may not be amiſs to employ ſome ſtimulating means before leading him to the female. He ſhould be kept on a generous diet, and when particularly required, he may have a cordial ball given him, with a quart of good ale after it. This will generally anſwer the purpoſe, or, if it does not, the animal is unfit for his office, and ſhould be diſcarded. It is a common practice among ſome grooms to inſert a ſlice of ginger into the fundament of an indifferent horſe, and this is ſaid to have the effect of rouſing his latent powers.

Indifference for coition is more likely to take place in the females of theſe animals, and it is no uncommon thing for a mare or a cow to refuſe the male. In general this is owing to a poorneſs of diet; and theſe females ſhould, like the males, before being taken to be covered, be put on a generous diet with moderate exerciſe. Probably all ſtrong, ſtimulating remedies, ſuch as cantharides, which are ſometimes given, do more harm than good, as they may produce inflammation of ſome internal organ, without producing completely the deſired effect. The cordial ball and ſtrong ale are the moſt innocent remedies in theſe caſes, and where nature is tolerably ſufficient, they will be the moſt efficacious.

The parts of generation in theſe animals are ſubject to certain accidents or diſeaſes, and it is neceſſary that we ſhould notice the more common of theſe.

460 Falling of the penis. The horſe is ſubject to what is called a falling of the penis. This conſiſts in a relaxation, and total weakneſs of the parts deſtined to ſuſtain and ſupport it in its natural

Diſeaſes. ral ſtate, and is in fact a kind of paralyſis of the erector and accelerator muſcles, or a total atony of the ſuſpenſory ligament.

It may be produced by various cauſes, as by too great exertion in labour; hence it is common to draught horſes that are hard worked. It may alſo depend on a violent ſpaſm of the muſcles of theſe parts, as this is always ſucceeded by a proportionate relaxation and atony. It is not unfrequently produced when a ſtallion is made to cover too many mares in one ſeaſon.

When the caſe is ſlight, after returning the penis within the ſheath, which ſhould always be done, a pail or two of cold water, or of ſalt and water, may be thrown over it ſeveral times in the day, and the muſcles may be anointed with ſome ſtimulating liniment. It has been adviſed to make ſuperficial punctures about the yard with a ſharp needle, and then to waſh it with diſtilled vinegar; but we do not know whether this plan has been attended with the deſired ſucceſs. If the complaint continues obſtinate, the penis muſt be bolſtered up, and a charge applied over the back part of the ſheath ſo as to leave ſufficient room for the horſe to make water. If the complaint is attended with a general weakneſs, tonics and cordial remedies muſt be applied.

461 Falling of the womb. When a cow has been delivered with more than uſual difficulty, or has been very long in labour before procuring aſſiſtance, it not unfrequently happens that the womb is inverted, or, as it is commonly expreſſed, the calf-bed comes down. This accident is more likely to happen to ſome cows than to others, and is more eſpecially incident to thoſe of a weak habit of body, and ſuch as are unuſually wide between the thighs. In ſuch cows it would be proper to pay more than uſual attention about the time when labour is expected to take place, and the ſtall in which they are left ſhould be made very commodious, that they may frequently lie down, as the great weight of their burden will have moſt effect while they are ſtanding. When the calf-bed is come down, it ſhould be returned as ſoon as poſſible, by the operator clenching his fiſt after greaſing it and putting it to the middle part of the womb, which he is thus to puſh gently into its place, and when it is up, he muſt take care not to withdraw his hand too ſuddenly; but it would be better to keep it within the womb for a little, as it will ſtimulate the adjacent muſcles to preſerve the parts in the proper ſituation. After withdrawing the hand gently, the external parts ſhould be bathed with camphorated ſpirits, and the beaſt muſt be watched, to prevent the ſame accident from taking place again. It is the practice with ſome to lead the cow down a hill after returning the womb, as it is ſuppoſed that this is greatly advantageous to the parts recovering their proper poſition. If proper aſſiſtance cannot ſoon be procured, the inverted womb ſhould be laid on a clean ſoft linen ſheet, and carefully covered from the air, the irritation of which, might produce an inflammation. If the relaxation of the parts is ſo great that the womb ſtill comes down, recourſe muſt be had to a ſtay, to put behind, to prevent the womb from falling down; and ſome have recommended ſtitching it to the adjacent parts with a wax thread. Probably this operation would be attended with more danger than benefit.

462 Abortion. Cows and mares ſometimes ſuffer abortion, or as it is called, ſlip their calf or foal, before the uſual time of labour. This accident may be brought on by violent exerciſe, eſpecially by leaping hedges and ditches; by ſudden frights, knocks, or bruiſes; and it is alſo ſaid that it may ariſe from bad ſmells, and ardent deſire in the mare or cow; but theſe latter cauſes are probably imaginary. It is adviſed by ſome to keep cows who have ſlipt their calves as free from having any communication with the reſt of the cattle as poſſible, under the idea that the accident may become infectious; and it is declared that experience has ſhown, that without great care and management it may go through the whole ſtock, and even return the next ſeaſon, if the ſame cattle are kept. We cannot vouch for the truth of theſe aſſertions, but if true, the circumſtance is very remarkable. Diſeaſes.

When a cow or mare has ſlipt her young, unleſs this accident has been occaſioned by great exertion, it is a proof that the animal is extremely weak, and ſhe muſt be put on a more nouriſhing diet, and have ſtrengthening remedies; but in general little is required after ſuch an accident, but reſt, and perhaps a warm bran maſh. This latter may be frequently given to mares or cows during pregnancy, as coſtiveneſs may be a great means of producing abortion.

SECT. II. OF COMPLICATED DISEASES.

463 Many of the diſeaſes, that have been treated of in the laſt ſection, are very important, and ſeveral of them highly dangerous; but thoſe which we are now to conſider, have a ſuperior claim to our attention, either from their fatality, the rapidity of their progreſs, or their intimate connection with ſome of the moſt important or deſtructive maladies that affect the human race. They will, therefore, require a ſomewhat fuller diſcuſſion than we have thought it neceſſary to give to the diſeaſes deſcribed in the laſt ſection.

We ſhall claſs them under the ſeveral heads of Fevers and Febrile Eruptions; Inflammations; Lethargic diſeaſes; Spasmodic diſeaſes; Dropsies; and Anomalous diſeaſes; which will form the titles of as many chapters, the laſt comprehending thoſe affections, of which the nature or cauſes have not been fully aſcertained, with thoſe that could not properly be reduced under any of the former heads.

For the general doctrine of fevers, inflammations, comata, ſpaſms, and dropſy, we muſt refer to the medical articles of this work.

Chap. I. *Of Fevers and Febrile Eruptions.*

464 Inflammatory fever. All the domeſtic animals may be affected with primary fever; and this may be either of an inflammatory or putrid kind.

1. Inflammatory Fever. Synocha.

Inflammatory fever, is we believe, ſeldom ſeen as a primary or idiopathic complaint, except in the horſe; and to the conſideration of this fever, in that animal, we ſhall here confine ourſelves. The ſymptoms are thus deſcribed by Mr Blaine:

"It is not eaſy to ſay what is the firſt ſymptom of fever in the horſe; but from the effects that we ſee ariſe in ſome caſes, it may be preſumed that it is a cold fit. It is uſual however firſt to obſerve this complaint, by

Diſeaſes. by the loſs of appetite, and dull heavy appearance of the animal; the extremities are cold, and the trunk hot, or the body is cold, and ears are hot. If a horſe is attacked with common fever, while he is at graſs, he is found reſtleſs, roving about the field, with an unſteady ſtaggering air, and his head held low; if in the ſtable, frequently ſhifting his poſition, and is evidently reſtleſs and uneaſy. His pulſe is generally full, frequent, and hard, the two latter ſtates of it are almoſt always preſent, but the former may vary. If the mouth is examined, it will be found hot and dry, and frequently ſmells ſtrong; the breath is particularly hot, and there is often an increaſed redneſs of the inner membrane of the noſe, even though there ſhould be no primary affection of the lungs. The eyes are dull, heavy, and ſometimes inflamed, and the horſe ſtarts, and is at times drowſy, but has no regular ſleep. In this fever the ſecretions are generally diminiſhed, therefore the dung is hard, and in ſmall quantities; the urine ſparingly made, and high coloured, and the excretions from the ſkin equally confined, giving it a dry harſh feel. The reſpiration is quickened, which is ſhewn by the heaving at the flanks, and which muſt be diſtinguiſhed from that difficulty accompanying inflammation of the lungs; in which caſe the air appears drawn through a part too ſmall for it, as though we were to breathe through a quill; but in fever it is uſually only ſimply accelerated.

"This forms the firſt ſtage of the complaint, and ſometimes immediately ſucceeding to this, is an attack on ſome one particular organ, as the brain, lungs, bowels, or kidneys; in which caſe it ceaſes its primary affection, and becomes ſecondary and ſymptomatic; but when it remains purely of the febrile type, as the diſeaſe advances the ſymptoms become more irregular, ſeldom appearing the ſame in any two ſubjects, ariſing from particular ſtates in the individual bodies, varieties in the treatment, or from ſome peculiarities in the diſeaſe itſelf. The pulſe in this ſecond ſtage continues hard, but loſes ſome of its fulneſs, and increaſes in frequency; the ſkin becomes moiſter, the urine is ſecreted in rather larger quantities, and ſometimes to theſe ſucceeds a purging; the watchfulneſs increaſes, and the horſe is often obſerved in theſe caſes to chew a lock of hay, and let it fall from his mouth again, as though inſenſible of its eſcape.

"This diſeaſe ſeldom remains very long in this ſtate; but there either ſucceeds a gradual abatement in the hardneſs and frequency of the pulſe, the countenance becomes more lively, the muſcular weakneſs increaſes; but the irritability leſſens; the animal appears more tranquil; the ſecretions gradually return to their natural ſtate; the mouth becomes moiſt, and the heat regular and equable; and thus is formed a reſolution of the fever. This kind of fever, I believe, ſeldom terminates in a criſis, nor often by ſweating; perhaps, it may ſometimes by purging.

"But when to the foregoing ſymptoms, inſtead of their latter appearances, there ſucceeds great reſtleſsneſs, or ſometimes conſtant drowſineſs, the pulſe becoming very quick, as from 70 to 80 pulſations in a minute, preſerving ſome of its hardneſs, and accompanied with profuſe ſtaling, though at others the urine remains high coloured, and ſmall in quantity, and the thirſt unabated; when to theſe are added great proſtration of ſtrength, a fatal termination may be expected *."

* *Blaine's Outlines*, vol. ii.

We have ſaid that ſimple fever is not common in ſheep or cattle; but when it occurs in theſe animals, the ſymptoms differ little from thoſe above deſcribed. Diſeaſes.

It muſt be remarked, that though the foregoing deſcription will apply to moſt caſes in horſes, all the ſymptoms here laid down will not often be found in the ſame caſe; but they will vary according to the conſtitution of the animal and other circumſtances. Sometimes the fever will have leſs of the inflammatory type, and will approach to what is called a low or nervous fever. Caſes of low nervous fever are, however, very uncommon among horſes. Mr Blaine ſays that he has met with no inſtance of this kind, but that he was aſſured by a Mr Bloxham, a veterinary practitioner of conſiderable obſervation, that he had met with a well-marked caſe of typhus fever. In caſes that approach this low type, the heat of the body is more irregular than in the pure inflammatory fever, and the mouth often continues moiſt though drink be refuſed; and the ſecretions and excretions are uſually not ſo much affected. Sometimes there takes place a diſcharge of glutinous matter from the noſe, and the eyes are watery. The pulſe in theſe caſes uſually ceaſes to be full after the firſt 24 or 36 hours; and though it ſtill continues hard, it is more frequent than before, and becomes ſmall and irregular as the diſeaſe advances. This low variety of fever is more dangerous than the true inflammatory fever, and requires more particular attention.

Inflammatory fever may be produced by any cauſe that violently agitates the body, and unuſually accelerates the motion of the blood. It may be produced by exceſſive exertion and fatigue, or by an expoſure to cold while the body is overheated. It is ſaid to have been ſometimes brought on by a ſudden fright. A very common cauſe in hot climates, is long expoſure to the direct rays of the ſun. Pure inflammatory fever is certainly not contagious.

In the cure of inflammatory fever it is neceſſary to draw blood as ſoon as poſſible; and the quantity of blood taken away ſhould be in proportion to the violence of the inflammatory ſymptoms. We are diſpoſed, however, to think, that a leſs quantity than is uſually recommended, perhaps not more than two quarts at once, will be ſufficient, as the weakneſs that comes on in the latter ſtages of all fevers, will be greatly increaſed by too much loſs of blood. The blood ſhould be preſerved in a proper veſſel, as directed in N° 162. that it may be aſcertained how far it will be proper to repeat the operation. When blood has been drawn, the horſe ſhould be back-raked, or a hand paſſed up the rectum, and the dung drawn carefully away; after which a clyſter ſhould be thrown up, ſuch as N° 17. of the receipts. It ſhould be blood-warm, and ſhould be paſſed up carefully and gently. If there is much determination to the head, a bliſter may be applied to the neck, or a ſeton inſerted as near the head as may be. Cooling medicines may be adminiſtered, ſuch as the drenches, N° 22. and N° 26. All heating or cordial medicines, and ſtimulating food ſhould, in the early ſtage of the fever, be carefully avoided. The diet ſhould conſiſt of light food that is eaſily digeſted, ſuch as ſweet hay, or, if that can be procured, lucerne or ſainfoin; bran maſhes, and, by way of drink, thin gruel.

The rational mode of treating fevers, lately introduced

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ced into human medicine, will probably not ſoon be transferred to the ſtable. Grooms and farriers will not eaſily believe that it is neceſſary to keep a feveriſh horſe cool, and allow him to breathe a free, pure air. The practice uſually followed in theſe caſes is to ſhut up the ſtable as cloſely as poſſible, and even to ſtop every cranny in the door and windows. This practice is not only ſufficient to increaſe the diſorder of the feveriſh horſe, but even to excite fever in ſuch horſes as happen to be in the ſame ſtable. It is, beſides, cuſtomary to cover up the horſe with a load of body-clothes, in order that he may ſweat off the fever; and probably theſe clothes are girded tight round his body by means of rollers.

Inſtead of this abſurd method of treatment, a feveriſh horſe ſhould, if poſſible, be put into a ſtable where there is not more than one horſe. As theſe animals naturally love ſociety, it is better that he ſhould not be quite ſolitary, otherwiſe he might be put in a ſtable by himſelf. The ſtable ſhould be roomy and airy, and ſhould be regularly cleaned. The horſe may have a light cloth thrown over him, but this ſhould not be faſtened more than is ſufficient to keep it from falling off his body.

When the inflammatory ſymptoms have ſubſided, and ſigns of debility begin to make their appearance, as they never fail to do in the courſe of a few days, a different plan of treatment will be required, as far as reſpects the adminiſtration of internal remedies. A horſe labouring under fever muſt be carefully watched, in order to mark the time at which the inflammatory ſymptoms begin to give way to thoſe of lowneſs and debility; and as the change is often very ſudden, the horſe ſhould be viſited at leaſt twice a-day, or oftener if poſſible, as were the groom or other attendant to continue the debilitating treatment after the ſymptoms of debility come on, ſuch a degree of weakneſs may be produced as will not eaſily be recovered. The change will be diſcovered chiefly by the alteration of the pulſe, which, from being hard and full, becomes ſofter, and in general weaker. This is the time to exhibit ſtrengthening medicines; but theſe at firſt ſhould be of the gentler kind, ſuch as Peruvian bark, or willow bark, which may be given at firſt in moderate doſes; and if the debility continues, the doſe muſt be increaſed, and the medicine adminiſtered more frequently. During the whole treatment, care muſt be taken that the horſe be not ſuffered to remain coſtive, and his bowels may be kept moderately open, by giving him a warm maſh every night. If the weakneſs becomes very great, and there appears much reſtleſſneſs or heavineſs, while the pulſe continues low, it will be proper to adminiſter ſome of the more powerful ſtimulant medicines, as camphor and opium, ammonia, or ſnake-root, as directed in the receipts N°. 35. and 38. As the horſe becomes convaleſcent, the ſtronger tonics, as oak bark, with ginger, may be adminiſtered twice or thrice a-day; and as his appetite returns, he may be indulged with his uſual food, with gentle exerciſe. It will be proper, however, to avoid any conſiderable exertion for a long time after the animal has become convaleſcent, as a conſiderable period muſt elapſe before the body can recover its uſual ſtrength and vigour.

Inflammatory fever precedes or accompanies moſt violent inflammations, eſpecially thoſe of the brain and other viſcera, and it generally uſhers in ſeveral of the eruptive diſeaſes. In ſome of theſe complaints the fever demands particular attention; but in moſt of them it is merely a ſecondary ſymptom, and yields to the general treatment of the diſeaſe. Diſeaſes.

2. Epidemic Putrid Fever. Typhus. *Murrain, Peſt, Garble.* Epizooteé, Fr.

465 Putrid fever.

Putrid fever does not commonly attack horſes, though it has occaſionally raged epidemically among theſe animals. Lanciſi, an Italian phyſician, has deſcribed an epidemic fever that raged among horſes in Italy about the year 1712, and Mr Oſmer mentions an epidemic of a ſimilar kind, attended with critical abſceſſes. He calls it the diſtemper, and ſays that it had raged at different periods for more than 50 years.

466 Murrain.

The moſt ſerious epidemic fevers that have ever appeared among domeſtic animals, are thoſe which, from their violence and fatality, have been called *murrains*, or *peſts*, and which have raged occaſionally from the earlieſt hiſtorical accounts.

Columella mentions a contagious diſeaſe, which he calls *cruditas*, that ſcarcely differs in its ſymptoms from the murrains that we are preſently to deſcribe. The following is his deſcription. "Crebri ructus, ac ventris ſonitus, faſtidia cibi, nervorum intenſio, hebitas oculi, propter quæ bos neque ruminat, neque lingua ſe deterget." He adviſes bleeding in the tail, and back-raking, and clyſters; and if it appears that the diſeaſe is contagious, he recommends the infected cattle to be ſeparated from the reſt of the herd.

A ſimilar diſeaſe is alſo deſcribed by Vegetius, who recommends a ſimilar treatment, with the additional advice: "Mortua cadavera ultra fines villæ projicienda ſunt, et altiſſimè obruenda ſub terris;" To carry the carcaſes to a diſtance from the farm, and bury them deep in the earth.

Marius, a Burgundian eccleſiaſtic, who wrote in the 6th century, mentions a diſeaſe, which he conſiders as the ſmallpox, that deſtroyed great numbers of cattle. "Hoc anno (570) morbus validus, cum profluvio ventris et *variola*, Italiam, Galliamque valdè afflixit, et animalia bubula per loca ſuperſcripta maxima interierunt." *

* *Muirhead's Travels in the Low Countries.*

The firſt accounts that we have of any diſorder of this kind, ſince the beginning of the preſent century, are related by Ramazini and Lanciſi, two phyſicians then living in Italy, where this diſorder firſt broke out, in the year 1711, in the territories of the republic of Venice in the country round Padua; and was ſaid to have been brought from Dalmatia, a province of Turkey, by ſome merchants importing living cattle, according to their annual cuſtom, from that and the neighbouring parts. The diſeaſe ſoon ſpread itſelf through moſt parts of Italy beyond the river Po, and appeared two years after in the duchy of Ferrara, where it ſo ravaged the country, in the years 1713 and 1714, that Lannonius, a celebrated phyſician of that time, informs us, it was a prevalent opinion, that the whole ſpecies would quickly become extinct. From Italy it travelled through the Tyroleſe into France. Shortly after Germany ſuffered, as well as the low countries; and from theſe parts it was ſuppoſed to have been tranſported into Great Britain and Ireland. But there is no

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no record of a new infection in this country ſince the year 1714, till the middle of laſt century, when we probably received the infection from Holland, where this diſorder then reigned, having received the infection from ſome of the neighbouring parts of Germany and Flanders.

467 Appearance of the murrain in Britain.

About the year 1744, it was reported to have been brought by ſome traders into Eſſex, who had purchaſed calves in Holland, or ſome other of the provinces of the low countries, which had the infection, and ſpread through ſeveral counties, till it became a matter of importance to the ſtate; and on the 13th of February 1745 gave occaſion to the paſſing of an act of parliament, commanding that every probable, or even poſſible, means ſhould be employed, by officers appointed for that purpoſe, to prevent the farther ſpreading of it. Premiums were given to thoſe who killed their cattle as ſoon as the infection made its appearance; and fines were impoſed upon every one who acted in oppoſition to the eſtabliſhed laws, reſpecting driving, expoſing, or ſelling cattle, ſuppoſed or found to have caught the diſorder. Every precaution, however, which could be ſuggeſted at that time, proved ineffectual; and freſh orders were iſſued by his majeſty in council, which for ſome time were alſo found to produce very little effect. It became ſo alarming to the country, that many eminent medical characters in different parts of England, cloſely applied themſelves to the ſtudy of remedies for this calamitous diſtemper. They differed in opinion, whether it was a diſeaſe of an infectious nature, or proceeded from a malignancy in the ſtate of the atmoſphere, or ſome peculiarity in the nature of their food. The contradictory opinions which prevailed among them, nearly prevented ſome of the ableſt profeſſional men from appearing in behalf of the public; eſpecially Dr Barker, who wrote an ingenious pamphlet on the ſubject, and whoſe mode of treatment proved more ſucceſsful than that of many others, whoſe pretenſions were given to the public in a more confident manner, and more ſtrenuouſly ſupported.

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From the ſeveral hiſtories that have been given of the diſorder, it appears to have differed in its ſymptoms and effects, according to the countries in which it appeared; the various ſeaſons in which it commenced its ravages, and ſome other circumſtances not fully aſcertained. There ſeems to have been no doubt that the diſeaſe was infectious, or at leaſt that it was eaſily propagated among the ſpecies of animals which it attacked; but it does not appear to have been capable of ſpreading to other ſpecies; as men, horſes, ſheep, and dogs, that lived in the neighbourhood of the infected cattle, ſhewed no marks of having received the contagion.

In the hiſtorical ſketch of the writers on veterinary medicine, we mentioned ſeveral works on the ſubject of the murrains that prevailed over Europe in the laſt century; and of theſe it will have appeared that the greater part were the production of foreigners. The moſt celebrated of theſe foreign publications were thoſe of Sauvages, Goëlicke, and Camper. The work of the latter upon this ſubject is extremely valuable; and as it was written for the inſtruction of people in general, having been delivered in the form of lectures before a crowded audience, it is preferable to many others that have appeared on the ſubject. It is given in the third volume of Camper's works on natural hiſtory, phyſiology, and comparative anatomy, lately publiſhed at Paris. Camper delivered four lectures; in the firſt of which he explains to his hearers the ſtructure and direction of the principal blood-veſſels of the neck and extremities in cattle, and the natural poſition and appearance of the entrails of theſe animals. In the ſecond he deſcribes the natural ſtructure of the four ſtomachs, the liver, and the ſpleen, and of the heart and lungs. In the third he explains the function of rumination, or chewing the cud, in all ruminating animals, but eſpecially in cattle. In the fourth lecture he gives an account of the ſeveral writings that had appeared on the ſubject of *epizootic diſeaſes*; among which he particularly recommends a German work by Dr Krunetz, that of Goëlicke, and thoſe of our countrymen Brockleſby and Layard. In the ſame lecture he gives a very accurate detail of the ſymptoms of the diſeaſe as it appeared in the province of Groningen in the year 1768, with the appearances on diſſection; his own opinion with reſpect to the nature of the malady, and an account of the moſt approved method of treating it. We regret that this work came into our hands too late for us to make any conſiderable uſe of it in this article.

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The medical practitioners in England, to whom we are moſt indebted for an accurate account of the ſymptoms of this diſorder, and a rational mode of treating it, are Dr Brockleſby and Dr Layard. As the account given by theſe gentlemen differs in ſeveral particulars, though there can be no doubt that both deſcribe the appearances which fell under their own obſervations, we ſhall extract a few particulars from both their publications. The following is Dr Brockleſby's account of the diſeaſe.

469 Brockleſby's deſcription of the murrain.

For ten days or a fortnight the cattle were troubled with a dry cough, which is indeed not an uncommon ſymptom among cattle, at that time of the year, and therefore Dr Brockleſby did not conſider it belonging to the preſent diſeaſe; the hair was rougher on the ſkin than ordinary; their eyes looked heavy, and, when the principal diſorder appeared, they refuſed fodder, but had an inſatiable thirſt for a time: The milch-cows decreaſed in their milk, which remained to a certain quantity, ſometimes for two days, before it changed colour, but at length often dried up. Upon ceaſing to chew the cud, a ſhivering ſeized them all over, and a high fever immediately came on; the milk, if any remained to that time, curdled over the fire, but did not in the firſt of the diſorder. At firſt the belly was coſtive, but for the moſt part a looſeneſs ſucceeded within forty-eight hours after the ſhivering fit. The ſtools were firſt green and watery, and of a ſtinking ſmell; their conſiſtence, however, altered afterwards to a vifcid, ſlimy matter, the purging accompanied till about the ſeventh day, and about that time the excrements became thicker, in ſuch as recovered; and theſe ſoon chewed their cud again, and taſted of fodder, which they had before abſolutely refuſed through the whole diſeaſe. All that had not the looſeneſs before the third day died. The urine was very high coloured, and in ſmaller quantities. The degree of fever was obſerved very high; upon the third day the pulſe beat near a hundred times in a minute, whereas the ingenious Dr Hales found a ſound ox's artery not to exceed 38 pulſes, in the ſame time. At different inter-

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470 Appearances on diſſection. The appearances in the dead bodies of eight different cows were as follow: The fleſh was of a ſound colour, and everywhere lined with fat, the cellular membrane between the ſkin and fleſh was diſtended with air to above the thickneſs of three inches. The paunch was prodigiouſly diſtended with food, in all of them, but it contained not any thing preternatural; nor indeed in the *reticulum* or ſecond ſtomach, were there any morbid appearances; but, upon inciſion of the *omaſus*, or third ſtomach, in which the food is naturally without much juice, a moſt offenſive ſtench ruſhed out, with a large quantity of thin greeniſh water.

The blood-veſſels on the inner ſurface of the ventricle were very full. The abomaſus and part of the inteſtines diſcovered the like morbid phenomena. The liver, ſpleen, and kidneys were as uſual; but the gall-bladder ſeemed to be in the greater number fuller than ordinary; the conſiſtence of ſome was thicker than the reſt, and the gall taſted diſagreeably ſweetiſh. Dr Brockleſby did not obſerve any purulent matter inveſting the inner ſurface of the inteſtines, though other gentlemen diſcovered ſuch, in ſome cattle, if new as rightly informed; but there appeared in ſome a ſlimy mucus, all along the inteſtinal canal.

The lungs univerſally ſhewed the ſtrongeſt ſigns of a preceding high inflammation; moſt of them were turgid with red blood, while the ſmalleſt veſicles of the bronchia, or air-veſſels, were very much inflated. Some few arterious veſſels were replete with a gelatinous, glairy mucus, and all the lungs appeared larger than they do in common. The whole inner ſurface of the trachea, or wind-pipe, was covered with a frothy mucus; but he never found any ulcers with purulent matter either at the root of the tongue, or in the lungs. Upon opening two or three heads, he found large quantities of extravaſated ſerum; and the blood retained fluidity in the larger veſſels long after death.

471 His mode of treatment. The method of treating the cattle recommended by Dr Brockleſby is as follows: Before the cattle are ſeized, he adviſes two ſetons, or pegs, to be put deep into the dewlap, and into the under part of the neck; and immediately upon refuſing fodder, the beaſts ſhould have three quarts of blood taken away; and after twelve hours, two quarts more; after the next twelve hours about three pints may be let out; and after the following twelve hours, diminiſh a pint of blood from the quantity taken away at the preceding blood-letting; laſtly, about a ſingle pint ſhould be taken away in leſs than twelve hours after the former bleeding; ſo that when the beaſt has been blooded five times, in the manner here propoſed, the worſt ſymptoms will, it is hoped, abate; but if the difficulty and panting for breath continue very great, he ſees no reaſon againſt repeating bleeding, or at leaſt againſt taking away the fifth time, inſtead of a ſingle pound, twice that quantity. Diſeaſes.

In the mean time the ſetons or pegs ſhould be daily promoted to ſuppuration by moving the cord; and the cattle ſhould have as much bran-water as they chuſe to drink luke-warm. This ſhould be made a little tart or ſouriſh, either with common vinegar or ſpirit of vitriol; and immediately after the firſt bleeding they ſhould have a drench compoſed of a drachm and a half of camphor, well rubbed with two ounces of honey, adding an ounce and a half of nitre, and about a quart of water-gruel.

It is extraordinary that this treatment, with a little variation in the internal medicine is recommended by Mr Feron as the reſult of his own experience, in what he calls the general inflammation of cattle. It is a curious coincidence; as we ſuppoſe that Mr Feron, from his not noticing Dr Brockleſby's pamphlet, has never ſeen it.

The doctor recommends keeping the cattle very warm, and guarding againſt the admiſſion of any cool air, a practice in which he will ſcarcely be followed at the preſent day.

472 Layard's account of the murrain. The ſymptoms of this diſtemper as deſcribed by Dr Layard are, on the firſt appearance of the infection, a decreaſe of appetite; a poking out of the neck, implying ſome difficulty in deglutition, a ſhaking of the head, as if the ears were tickled; a hanging down of the ears, and deafneſs; dimneſs of the eyes; and a moving to and fro in a conſtant uneaſineſs. All theſe ſigns, except the laſt, increaſe till the fourth day. Then a ſtupidity and unwillingneſs to move, great debility, total loſs of appetite, a running at the eyes and the noſe, ſometimes ſickneſs, and throwing up of bile, a huſky cough, and ſhivering. The head, horns, and breath are very hot, while the body and limbs are cold. The fever, which was continued the three firſt days, now riſes and increaſes towards evening; the pulſe is all along quick, contracted, and irregular. A conſtant diarrhœa, or ſcouring of fœtid green faces, a ſtinking breath, and naſeous ſteams from the ſkin, infect the air they are placed in. The blood is very florid, hot, and frothy. The urine, or ſtale, is highly coloured; the roofs of their mouths, and their barbs, are ulcerated. Tumours, or boils, are to be felt under the panniculus carnoſus, or fleſhy membrane of the ſkin; and eruptions appear all along their limbs, and about their dugs. If a new milch-cow be thus ill, her milk dries up gradually, her purging is more violent, and on the fourth day ſhe is commonly dry. There is ſuch acrimony or ſharpneſs in their dung, that a viſible irritation is to be obſerved during ſome time in ano. They groan much, are worſe in the evening, and moſtly lying down. Theſe ſymptoms continue increaſing till the ſeventh day from the invaſion, on which generally, though

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though ſometimes protracted till the ninth, the criſis or turn takes place.

If after the ſeventh day from the invaſion (at which time a criſis may be expected), the eruptions, boils, or abſceſſes are decreaſed in bulk, or totally diſappear, without having broken or diſcharged outwardly, or an aggravation of the ſymptoms already mentioned, with no intermiſſion; it may be aſſuredly pronounced, that the beaſt will die.

As to the cure, immediately upon the firſt appearance of the diſtemper, the beaſt ſhould be put into ſome place where it may be kept clean, warm, and as free as poſſible from infectious ſteams of other beaſts in the ſame condition. The beaſt muſt be bled in proportion to its ſtrength, waſhed with warm water and vinegar, to clear the hair from filth and inſects, and rubbed every morning and evening, for a quarter of an hour, with a dry linen or woollen cloth, or ſtraw, to promote perſpiration. A rowel alſo is to be made in the dewlap, which is to be dreſſed twice every day, which rowel is alſo to be kept in a month at leaſt after the recovery of the beaſt.

Should the beaſt be hot, hang down his head, breathe with difficulty after the bleeding, dung hard, and the ſkin feel tight and thick; then it will be very proper to give a gentle, cooling purge in this firſt ſtage. When the beaſt has voided the hardened dung, or if it ſhould not have wanted purging, the following drench is to be given. Take of madder-root, three ounces; of tumeric and horſe-raddiſh-root, each one ounce; of fenugreek-ſeeds, bruiſed, two ounces; of chamomile-flowers, dried leaves of feverfew, rue, and ſage, of each one handful. Boil them half an hour in a gallon of ſmall ale, well hopped, to three quarts; then ſtrain the liquor, and give the beaſt three pints in the morning, and the remainder in the evening. No dry or ſolid fodder is to be offered till the beaſt chews the cud again. Between theſe drenches a quart or two of diſtilled vinegar-whey muſt be given frequently in the day, to dilute the hard fodder, and ſtrengthen the coats of the ſtomach; and hay-water may be alſo given. Great care muſt be taken, twice or thrice a-day, to cleanſe the mouth, barbs, and noſtrils of the diſtempered cattle, with ſome abſterging acidulated liquor. On the fourth day, if the beaſt be heavy, dull, ſhivering, no pimples or knots ariſe, and a purging be coming on, the following drench muſt be given at about eight in the evening, and repeated three or four nights, as occaſion requires.

Take of Virginian ſnake-root, contrayerva root, chamomile-flowers powdered, of each half an ounce; Venice treacle, ſix drachms: Mix all theſe in three pints of vinegar-whey, and give the drench lukewarm. Let a perſon ſit up all night with the beaſt, and give it frequently a quart of vinegar-whey. Venice treacle may alſo be ſerviceable; and if there be any ſigns of mortification from the dark and relaxed appearance of the mouth, the coldneſs of the ſkin, the black fetid dung, inſenſibility, &c. the Peruvian bark muſt be inſtantly given every four or ſix hours, as occaſion may require, taking the uſual medicines in the intervals. In the laſt ſtage, let the ſwellings that puff up the ſkin be opened and digeſted; and after the criſis takes place, if a ſcouring ſhould enſue, it is not to be haſtily ſtopped, though diligently watched and reſtrained, leſt it weaken the beaſt too much; and to cleanſe the ſtomach and bowels, let a purge of rhubarb, ſenna, &c. be given. Dr Layard adviſes to let the beaſt drink water-gruel lukewarm, and keep it on dry meat, though ſparingly; and at night to give an ounce of electuary of diaſcordium, in a quart or three pints of ſmall ale, warm. But if after the criſis the beaſt is coſtive, and the ſkin dry, harſh, and tight on the fleſh; dunging may be procured by giving in the evening a maſh of bran, with a handful of beans bruiſed, and an ounce of Epſom ſalt. He recommends, however, the greateſt exactneſs in obſerving when the criſis is over; for the leaſt laxative medicine, or opening food, at the height of the diſeaſe, and conſequently in the former ſtages of expulſion and maturation, will certainly bring on a ſcouring, attended with fatal conſequences, or at leaſt very difficult to be removed. In winter time, the cattle, upon recovery, ſhould not be turned out at once to the paſture-grounds, let theſe be ever ſo dry; but towards the middle of the day, in fair weather, turning them out two hours, and then bringing them in again, will gradually uſe them to the open air. In ſummer, morning and evening will be the moſt ſuitable times; for the heat of the ſun, or cold, may bring on other diſorders.

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"A farmer, (ſays Dr Layard), loſt ten head of cattle, and two more were dying, and ſeven others ill, when I took upon me the direction of the ſeven which were laſt fallen ill. By the preceding treatment five of theſe recovered. One cow, very near her time of calving, died; and the ſeventh was certainly loſt for want of obſerving the due time of the criſis, and purging too ſoon."

Such are the accounts given by Brockleſby and Layard, of the ſymptoms and treatment of this deſtructive malady; and it will be ſeen that their accounts differ no more than what may be expected from two different perſons deſcribing a ſimilar diſeaſe that occurred at two different periods; for the murrain deſcribed by Dr Brockleſby appeared in the years 1744 and 1745, while that of which Dr Layard has given an account occurred between 1750 and 1760.

The cauſes and nature of this diſeaſe have not been 473
exactly aſcertained. Some have ſuppoſed it connected with a peculiar ſtate of the atmoſphere, and that it did not originate in contagion. Many conſidered the principal cauſes of the diſeaſe to be previous hard winters, obſtructed perſpiration, worms in the liver, and corrupted food.

Hard winters have been conſidered as a cauſe of this diſeaſe, becauſe it was in 1710, after the hard winter in 1709 that the great mortality among the cattle was obſerved; and becauſe the hard winter in 1740 was followed by the contagion in 1741, which ſpread over the moſt part of Europe. Not to mention many others, the murrain in 1768, followed immediately after a pretty hard winter in 1767. On the other hand Camper remarks, that the hard winter in 1727 was not followed by the contagion; from which it would appear that the epidemic does not neceſſarily depend on the ſeverity or mildneſs of the preceding winter.

It was attributed by many to obſtructed perſpiration; and to prevent its attack, it was propoſed to cover the cattle during the nights of autumn, and to make them ſleep within doors during the ſpring nights.

Diſeaſes. It may, however, be obſerved, that if this reaſoning were true, the diſeaſe ought to have been leſs prevalent, or ought not to have appeared at all, in thoſe provinces where, for the ſake of ſaving the dung, they houſe the cattle at night, even in the ſummer, as well as in the ſpring and autumn. Beſides it appears that the contagion was not known at Bern, though the cattle in that diſtrict lay all night in the field whenever the weather would permit.

Camper juſtly ridicules the idea of the diſeaſe originating from worms in the blood, or in the liver.

"If (ſays Camper), you demand of me, to what I attribute the firſt origin of the diſtemper, I ſhall anſwer, as it were to be wiſhed that all naturaliſts would do in ſimilar caſes, that I do not know; that the ſubject is above my comprehenſion, and doubtleſs above that of every man*."

* *Oeuvres de Camper*, tom. iii. p. 120.

There ſeems no doubt, however, that the complaint was infectious, and that provided proper means were taken to prevent infection, the diſtemper would not ſpread. The means propoſed by Dr Layard and ſome other medical practitioners, to deſtroy the contagion, was to bury the carcaſes of the infected animals, and to ſlaughter all that appeared to have received the infection. Inoculation was propoſed by ſome, as a means of diminiſhing the ravages of the murrain; and is ſaid to have been practiſed in Denmark with conſiderable ſucceſs: but if this be true, it is probable that the epizootic diſeaſe that raged in Denmark was of a different nature from that which appeared in Britain, and on ſome parts of the continent; as inoculation ſeems to have been tried in theſe places without effect. What probably led to the propoſal of inoculation was, that the diſeaſe was conſidered by ſome as exactly ſimilar to the ſmallpox in the human body. This opinion was adopted by Dr Layard, and ſeems to have ariſen from the boils or ſuppurating tumours which appeared on the bodies of moſt of the affected cattle; but theſe tumours do not appear to be ſimilar to the eruption that takes place in ſmallpox, but rather reſemble the boils or buboes that take place in the plague and ſome other highly infectious fevers. On the whole, it ſeems to us pretty evident, that the diſeaſe is of the nature of putrid fever, and we have therefore ranked it under this head.

It appears from Camper's works, that inoculation was attended with ſo much ſucceſs in many caſes on the continent, that a great number of cattle was ſaved by it, who probably could not have been recovered from the natural diſeaſe. The advantages attending inoculation according to Camper are,

1ſt, That we can expoſe to the danger of contagion ſuch calves and heifers only as are of a moderate price.

2d, That the heifers paſs through the diſeaſe before they take the bull, and conſequently before they are pregnant. This is attended with more advantage than may appear at firſt ſight; for when the contagion attacks a whole herd, all at once, oxen, calves, heifers, and cows are ſeized without diſtinction. Such cows as are pregnant generally ſlip their calf, and even if they ſhould perfectly recover, their womb is ſo diſordered that it will never afterwards be capable of retaining the calf; beſides, that afterwards it is a long time before they come in heat, ſo that the proprietor is obliged to keep them for a whole year without deriving from them any benefit, except he fatten them for the butcher. Diſeaſes.

If the ſucceſs of inoculation, as well as the certainty of the cattle being incapable of a ſecond infection, were fully aſcertained, the plan of inoculation would be extremely proper. If theſe points were fully eſtabliſhed, would they not, however, militate conſiderably againſt the opinion that is entertained by the beſt writers on the ſubject, even by Camper himſelf, that this diſeaſe is an idiopathic putrid fever, and not an eruptive complaint like the ſmallpox?

474 Means of checking the contagion.

Conſidering the diſeaſe as one that is highly contagious, every method ſhould be taken to check the progreſs of the infection. For this purpoſe the houſes where the cattle are ſtabled, ſhould be kept perfectly clean, and well ventilated. It would alſo be proper to fumigate theſe places twice a-day with the vapours of ſome mineral acid, ſuch as the nitrous or muriatic acids, as has been recommended by Dr Johnſtone, Guyton Morveau, and Dr Carmichael Smith. This fumigation may be eaſily effected by placing pipkins of warm ſand in various parts of the cattle-houſes, and particularly at the doors, and placing on the ſand a cup containing common ſalt or pounded nitre, on which is to be poured a ſufficient quantity of ſulphuric acid or oil of vitriol, ſtirring the maſs now and then with a glaſs rod, to promote the eſcape of the acid vapours.

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We ſhall conclude this ſubject with a ſeries of queries that were circulated among medical men on the continent by the Society of Medicine at Paris, for the purpoſe of gaining every neceſſary information reſpecting this alarming peſtilence, as they may tend to direct the inquiries of thoſe who ſhall in future have an opportunity of obſerving the diſtemper.

1. What is the ſituation of the country in which the epidemic appears, and what is the nature of the ſoil?

2. Of what quality are the waters which the cattle uſually drink, and of what dimenſions are the reſervoirs that contain them?

3. What is the quality of the paſturage, and what are the plants which moſt conſtantly grow in the paſtures?

4. Of what nature is the fodder and the grain that are given to the cattle within doors?

5. Have there been any abundant rains or inundations; has the water continued for a long time on the ground, and what are the effects it has produced on the fodder?

6. Or has there on the contrary been any great drought, and how long has it continued?

7. What has been the ſeaſon for getting in the hay, and for harveſt: and what effect does the ſeaſon ſeem to have had on the hay and other fodder?

8. What circumſtances ſeem to have rendered it neceſſary for the cattle to work?

9. Has the diſtemper been announced by any previous ſymptoms; and what were they?

10. Did the diſeaſe come on with ſhivering, with coldneſs of the horns and ears, and with the loſs of appetite?

11. Did the heat come on ſoon after the cold fit, or was it not preceded by a cold fit?

12. Do the animals continue lying, without being able to raiſe themſelves on their legs?

13. When

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13. When they are lying, is their head low, or how do they hold it?

14. Are their eyes red, watery, and hot?

15. Are their noſtrils dry, or does there ooze from them a mucous matter?

16. Is their tongue in the natural ſtate, or is it very red, or is it covered with a yellow or brown mucus; is it moiſt or dry, or are there on it any tubercles?

17. Is their throat inflamed, or are there on it any aphthous cruſts?

18. Is the animal fatigued with a cough, and is this cough very frequent?

19. Do the flanks heave or not?

20. Does the animal ſeem to feel any great pain when he is touched in the flanks, or the belly, on the ſpine, or on the rump?

21. Are there any puſtules or tumours on the ſurface of the body?

22. Is the hair ſmooth or ſtaring, or does it eaſily come off when the ſkin is curried, or even when the body is rubbed with a wiſp of ſtraw?

23. Does the animal ſeem much diſordered, or does he refuſe every ſort of drink?

24. Does he chew the cud?

25. Has he a frequent diſcharge of urine, and what is the colour and conſiſtence of it?

26. Has he a diſcharge by ſtool more frequently or leſs than uſual, and are the excrements natural, or very dry or very liquid; what is their colour and odour, and is their diſcharge preceded or accompanied with a frequent exploſion of wind?

27. Are there to be obſerved any little convulſions below the ſkin, eſpecially about the neck?

28. Is the belly in its natural ſtate, or is it ſwelled; is it ſoft, or hard and tenſe?

29. At what periods do theſe ſeveral circumſtances take place?

30. How does the diſtemper terminate; what are the ſymptoms that announce a healthy termination, and what are thoſe which precede death?

31. In what ſtate after death are found the ſtomachs, the bowels, the liver, the ſpleen, the lungs, the heart, and the brain?

32. What remedies have been adminiſtered to the diſeaſed beaſt?

33. What ſenſible effects have theſe remedies produced?

34. Laſtly, what regimen has been obſerved in the convaleſcent ſtate?

476 Eruptive diſeaſes.

The eruptive diſeaſes incident to domeſtic animals are but few, when compared with the *exanthemata* that take place in the human body. Many ſuch diſeaſes are, however, deſcribed by veterinary writers, eſpecially on the continent, where they ſeem to be much more prevalent than among us. In particular, it appears, that in the ſouthern parts of Europe the ſheep are frequently affected with an eruptive diſeaſe that nearly reſembles the ſmallpox; and, like this diſeaſe in the human ſubject, there are two varieties of this affection, a *diſtinct* and a *confluent*. A very particular account of this diſeaſe, as it occurred at Cauterets in the department of the Lower Pyrenees in France, was drawn up by M. Tenon, and communicated by him to the agricultural ſociety at Paris; and a tranſlation of it has been publiſhed in the Farmer's Magazine for May 1804, from which we have taken it. Diſeaſes.

3. Sheep-pox. Claveau, Fr.

477 Sheep-pox

This diſtemper, which at Cauterets is called the ſmallpox, is contagious; and indiſcriminately attacks wedders, ewes, lambs, and goats, more eſpecially when ſhut up during winter in confined cots, the animals are kept very hot. It is a very ſingular circumſtance, that this diſtemper ſhould only appear at Cauterets, after intervals of twelve, fifteen, or twenty years; while in Guienne, and the higher Languedoc, it rages every year. Beſides, that in the former mountainous tracts, the weather is colder than in the plains of the latter diſtricts, the ſheep of the Pyrenees are kept more apart from each other than in the low countries, and the different flocks are much leſs liable to meet together, or to paſs through the ſame roads, by which they are not nearly ſo much expoſed to the danger of infection.

When ſeized with this diſtemper, the ſheep become dull and weak, and they loathe their food; the head, eyes, ears, and gums, are ſwelled; and hard white tumours appear in the groins and under the joint of the ſhoulder. Three or four days after the appearance of theſe tumours, pimples break out in different parts of the body. At firſt, theſe are ſituated on the naked ſkin between the thighs, and on the places where the wool is ſhort and ſcanty; afterwards, they break out about the head, and ſucceſſively over the whole body, even on the eye-lids, ears, and throat. In this ſtage of the diſeaſe the animal ſwallows with pain, being obliged to hold back the head, and to ſtretch out the neck for the purpoſe, and it breathes with great difficulty. As the diſeaſe goes on, the pimples enlarge, and become inflamed, particularly at their baſes; they ſuppurate and burſt; the matter which runs out mixes with the wool, and mats along with it into hard lumps, but afterwards drys and falls to powder; the wool falls off in locks; and even the ſcarf ſkin peels off in large pieces, which are full of holes. When the diſtemper begins to abate, the ſheep rub themſelves on the poſts of the racks, or any other hard ſubſtance which comes in their way; and by this means the wool, along with the looſe ſkin and dried pus, are rubbed off. If proper precautions were not employed, this would infallibly ſpread the contagion by infecting any other ſheep that might be brought into the ſame cots: but, on purpoſe to deſtroy the infection, new cribs are either ſubſtituted for the old ones, which are pulled down and burnt, or elſe the infected cribs are waſhed with cream of lime, and the cots are thoroughly fumigated with burning juniper and other aromatic plants.

There are ſeveral varieties of this diſorder. In ſome of theſe the eruption of puſtules is by no means complete as above deſcribed; ſometimes the pimples grow black, and dry up without coming to ſuppuration; at other times the diſeaſe is of a complicated nature. But as the diſorder only appears at diſtant periods among the ſheep at Cauterets, we are not to expect very full information concerning its various degrees from the ſhepherds of that diſtrict; neither have they any decided experience of the effects of ſulphur, or ſetons, or

Diſeaſes. or of bliſters, in the cure of this diſtemper. Bliſters are ſaid to have ſcarcely any effect upon the ſkins of ſheep.

It is certain, that the fleſh of ſuch ſheep, as have died of this diſorder, is very unwholeſome, has a very bad taſte, and is even dangerous to eat; and they add, that when dogs happen to feed on it, they catch the diſeaſe, and ſpread it by infection. Three cats, by eating this food, had their heads affected with an eruption of puſtules, by which they were firſt blinded, and afterwards loſt their lives. Hence the neceſſity of the precaution which is taken at Cauterets to bury deeply the carcaſes of ſheep which die of this diſeaſe.

I had an opportunity, ſays M. Tenon, at a butcher's in Paris, to examine ſome ſheep which had died of this diſorder. The ſkins were covered with ſuppurated puſtules, which penetrated as far as the cellular membrane, and the fat in their neighbourhood was affected for a conſiderable diſtance all round, being browner and firmer than the ordinary fat; and this alteration penetrated even to the fleſh.

The inhabitants of Cauterets affirm, that theſe puſtules are found on the liver and other internal parts of the body.

M. Tenon made every poſſible inquiry to learn whether this diſeaſe was ever communicated from the ſheep to mankind, but he could learn no inſtances of ſuch infection: it is believed, however, in Languedoc, that it is communicated from ſheep to rabbits. He could not learn whether the ſheep were ever affected a ſecond time with the ſame diſorder; but we cannot expect information at Cauterets on this part of the ſubject, ſince the diſeaſe only appears there for a ſingle ſeaſon, after intervals of twelve, fifteen, or twenty years, while the ſheep live but eight, or at moſt, ten years; ſo that any of them, which have once been diſeaſed, cannot be alive when the next period of contagion comes round.

Whenever the diſorder appears in the flock, the infected animals are ſeparated from the reſt, and ſhut up in warm cots, having plenty of wheat or barley ſtraw given them for litter; they are fed with hay and aftermath which have been made on a dry field, with a little ſalt, and are allowed lukewarm water for drink.

In the flat country at Tarbes, which is ten leagues diſtant from Cauterets, and conſiderably warmer than in the Pyrenees, and where this diſtemper is much more frequent, a different method of treatment is followed. At the beginning of the diſeaſe blood is drawn by cutting the ear; the cots are fumigated for five or ſix ſucceſſive days, by burning aromatic and ſtrong ſmelling herbs, preferring the dried ſtems of garlic for this purpoſe; theſe are burnt on a large ſtone in the middle of the cot, while all the vent holes are carefully ſtopped, to prevent, as much as poſſible, the ſmoke from eſcaping. The ſhepherds of Tarbes have great confidence in the beneficial effects of fumigating with garlic ſteams, which occaſions a great diſcharge from the noſtrils, eſpecially in ſuch caſes of the diſeaſe as are complicated with catarrhal diſorders, and with the ſtaggers or vertigo.

At Bellegarde, near Auch, they give to each beaſt a double handful of white mulberry leaves, which they alledge is a moſt effectual cure, and ſerves excellently for preventing the attacks of the diſeaſe.

When, at Cauterets, the diſorder begins to abate, whatever be the ſeaſon of the year, the animals are clipt, on purpoſe to aſſiſt the drying of the puſtules, and to favour the growth of a new fleece. After this the ſheep fatten very quickly; and it is worth while to remark, that the fleece which immediately ſucceeds this diſeaſe is finer and more ſilky than any former or future fleece on the ſame beaſts. Diſeaſes.

Formerly this diſeaſe made great ravages among the ſheep at Carcaſſone, till a method was fallen on to inoculate the diſeaſe. M. Tenon learned this fact in 1762 from Dr French, an Iriſh phyſician, who lived in Languedoc for ſeveral years; but it was not till 1763 that he received particular information on this curious ſubject from M. Berra, mayor of Carcaſſone, to whom he had written for information, and who procured him a memoir on the diſeaſes of ſheep in that part of the country. From this memoir the following account of inoculating the ſheep-pox is extracted.

"The ſeigneur of Maux, in the dioceſe of Narbonne is the firſt, and almoſt the only perſon who has practiſed inoculating the ſmall-pox on his flocks; and having been ſucceſsful during ten years experience of the practice, his widow has ever ſince continued to follow his example.

"In the month of September, when the heat of ſummer is paſt, and before there is any danger of very cold weather; while the paſtures are ſtill in good order, and the lambs, which are now ſix or ſeven months old, are ſtrong enough for withſtanding the force of the diſeaſe, this ſeaſon is choſen as the fitteſt for communicating the ſmall-pox to the ſheep. For this purpoſe the freſh ſkin of a ſheep, either ewe, wedder, or lamb, which has died of the diſeaſe, or, inſtead of that, one taken from a ſheep which has been killed while affected by it, is placed on the floor of the cot. Into this cot all the young ſheep of the year are driven, and they voluntarily rub and roll themſelves on the diſeaſed ſkin. Very ſoon afterwards the ſymptoms of the diſeaſe begin to appear; they have a dull and heavy appearance, hold down their heads, are ſomewhat fevered, and loathe their food. On purpoſe to aid the eruption of the puſtules, bread dipt in wine is given to the ſheep; they are anxiouſly preſerved from being expoſed to great heat or great cold, and particularly from rain. By theſe precautions they ſpeedily recover, and it very rarely happens that even one dies out of a flock of three hundred.

Although the diſorder has often ſpread over the diſtricts in the neighbourhood of the eſtate where this practice prevails, there has been no inſtance of a ſingle ſheep, after undergoing the above deſcribed operation, having been infected a ſecond time. It ought to have been noticed, that the inoculated flock is carefully prevented from mixing with any other ſheep, by keeping it in a ſeparate cot, and on a particular paſture, the other ſhepherds being forbidden to uſe either for the flocks under their charge. By theſe precautions, the diſeaſe is prevented from ſpreading, and ſuch proprietors as do not wiſh to have their ſheep artificially infected, have themſelves to blame if they do not avoid the place where the diſeaſed ſheep are kept. Since this practice has been followed, it has been obſerved that the diſorder has not returned ſo frequently, but that it has not proved

Diſeaſes. proved in the leaſt degree deſtructive to the flocks which have not been inoculated.

M. Berra adds, that the lambs never loſe their wool under the influence of the inoculated diſorder, and that their fleeces are equally good in every reſpect with thoſe of the uninfected, ſo that no difference can be perceived *.

* *Farm Mag.* vol. v. p. 175.

This diſeaſe was once pretty common in Britain, but is now ſcarcely known among us. It is, however, juſtly apprehended, that importation of ſheep from the continent may again introduce it; and Sir Joſeph Banks has taken much pains to caution the public againſt the danger of ſuch an introduction.

4. Cow-pox, or *Kine-pox*. Vaccina.

478 Cow-pox.

A greater bleſſing was never procured to mankind than what has been already derived, and will we truſt, be ultimately derived, from the invaluable diſcovery of the inoculated cow-pox, in preventing the perſon who has received it from being afterwards liable to variolous contagion. For this bleſſing we are certainly indebted to the labours and experiments of Dr Edward Jenner. There is no doubt that the diſeaſe was known many years ago in ſome of our principal dairy diſtricts; but Dr Jenner has all the merit of having extenſively circulated the diſcovery, and of having firſt applied it to thoſe valuable purpoſes to which an almoſt univerſal experience has ſhown it to be well adapted.

The ſymptoms and origin of this diſeaſe amongſt cows, have been briefly deſcribed by Dr Jenner in his publications on the ſubject. The firſt of theſe appeared in 1798, while Dr Jenner was practiſing in Berkely in Glouceſterſhire, where he had an opportunity of frequently ſeeing the diſeaſe.

"In this dairy country, (ſays Dr Jenner) a great number of cows are kept, and the office of milking is performed indiſcriminately by men and maid ſervants. One of the former having been appointed to apply dreſſings to the heels of a horſe affected with the greaſe; and not paying due attention to cleanlineſs, incautiouſly bears his part in milking the cows with ſome particles of the infectious matter adhering to his fingers. When this is the caſe, it commonly happens that a diſeaſe is communicated to the cows, and from the cows to the dairy maids, which ſpreads through the farm, until moſt of the cattle and domeſtics feel its unpleaſant conſequences. This diſeaſe has obtained the name of the *cow-pox*. It appears on the nipples of the cows in the form of irregular puſtules. At their firſt appearance they are commonly of a paliſh blue, or rather of a colour ſomewhat approaching to livid, and are ſurrounded by an eryſipelatous inflammation. Theſe puſtules, unleſs a timely remedy be applied, frequently degenerate into phagedenic ulcers, which prove extremely troubleſome. The animals become indiſpoſed, and the ſecretion of milk is much leſſened †".

† *Jenner's Enquiry*, p. 3.

There ſometimes appears another kind of eruption on the udder of the cow, which on a ſuperficial view may be miſtaken for cow-pox. It conſiſts of a number of white bliſters on the nipples, and theſe bliſters are filled with a whitiſh ſerous fluid. They are to be diſtinguiſhed from the puſtules that take place in the cow-pox, by their not having the blueiſh colour of the latter, and by their never eating into the fleſhy parts, being confined to the ſkin, and ending in ſcabs. This eruption alſo appears to be infectious, but not nearly in ſo great a degree as the true cow-pox. Diſeaſes.

Dr Jenner conſiders this ſpurious eruption as being chiefly produced by the tranſition which is made by the cow, in the ſpring, from a poor diet to one that is more nouriſhing, by which the udder at this ſeaſon becomes more than uſually vaſcular for the ſupply of milk. There is, however, another ſort of inflammation and puſtules, which appears to be not uncommon in all the dairy counties in the weſt of England. A cow intended to be expoſed for ſale, and having naturally a ſmall udder, is for a day or two previouſly neither milked by the milker, nor is her calf ſuffered to have acceſs to her; thus the milk is preternaturally accumulated, and the udder and nipple become greatly diſtended. The conſequences frequently are inflammation and puſtular eruption.

479 Originates in greaſe.

As the eruption of the cow-pox diſappears in a few days, little more is required than to keep the teats clean, and handle them as carefully as poſſible during milking.

The fact of cow-pox originating from the matter of *greaſe*, or of the latter being capable of producing the former, was, we believe, firſt diſcovered by Dr Jenner; but the opinion was for ſome time conſidered as fallacious. Many unſucceſsful attempts were made by Dr Woodville and by Mr Coleman to produce cow-pox by inoculating the udders of cows with matter from greaſy heels. Some experiments made by Mr Simmons tended ſtill further to diſprove Dr Jenner's opinion. But about five years ago, Dr John Loy publiſhed a ſmall pamphlet, in which he has related ſome experiments made by himſelf, with a view to determine this controverted point. He was led to make theſe experiments from ſome caſes that fell under his obſervation, of a diſeaſe very ſimilar to the cow-pox appearing on perſons who muſt certainly have derived it from the matter of greaſe. Dr Loy's experiments fully confirmed the opinion of Dr Jenner, and proved that the matter of greaſe would, by inoculation, produce in the human body a diſeaſe exactly reſembling cow-pox, and like it capable of protecting the inoculated perſon from an invaſion of the ſmall pox. Dr Loy alſo proved, that in ſome caſes, the cow-pox might be produced in cows by the immediate application of the matter of greaſe, but that this experiment did not ſucceed unleſs the horſe had alſo a general affection of the ſyſtem. This led Dr Loy to ſuppoſe that there exiſt two ſpecies of greaſe, the one merely a local affection, the other a general affection of the ſyſtem *.

* *Loy's account of Experiments on the Origin of Cow-pox.*

The reaſons that induced Dr Jenner to ſuppoſe that cow-pox originates in greaſe are thus ſtated by himſelf, in his ſecond publication on the ſubject of cow-pox.

Firſt, He conceived greaſe to be the ſource of cow-pox, from obſerving that where the cow-pox had appeared among the dairies in Glouceſterſhire (unleſs it could be traced to the introduction of an infected cow or ſervant), it had been preceded at the farm by a horſe labouring under greaſe, which horſe had been attended by ſome of the milkers.

Secondly, From its being a popular opinion through that dairy country, and from its being inſiſted on by thoſe who there attend ſick cattle.

Thirdly, From the total abſence of the diſeaſe in Scotland and Ireland (as the doctor was informed from the beſt authority) where the men ſervants are not employed in the dairies.

Fourthly,

Diſeaſes.

Fourthly, From having obſerved that morbid matter generated by the horſe, frequently communicates in a caſual way, a diſeaſe to the human ſubject ſo like the cow-pox, that in many caſes it would be difficult to mark the diſtinction between the one and the other. The truth of this obſervation is well illuſtrated by the above experiments of Dr Loy.

Fifthly, From his being induced to believe from experiments, that ſome of thoſe who had been thus infected by the horſe, reſiſted the ſmallpox.

Sixthly, From the progreſs and general appearance of a puſtule on the arm of a boy whom he inoculated with matter taken from the hand of a man that had been infected by a horſe, and from the ſimilarity to the cow-pox, of the general conſtitutional ſymptoms which followed. *

* *Jenner's further Obſervations*, p. 21

480 Le Louvet.

5. Le Louvet.

Continental writers deſcribe a variety of eruptions under the general name of *charbon*, or *carbuncle*, which affect various parts of the body, and have received different names according to the part which they attack. We ſhall here only notice one of theſe which raged epidemically about the middle of the laſt century in Switzerland, where it is called *le Louvet*.

It affected both cattle and horſes, but ſeems to have been attended with different ſymptoms in each. According to M. Reynier, a phyſician at Lauſanne, who publiſhed an account of the diſtemper, when an ox is ſeized with it, he ſuddenly loſes his ſtrength, trembles, ſeems deſirous of lying conſtantly on the ground, whence he ſeldom moves except to refreſh himſelf; he carries his head low, and his ears ſlouching; he is ſad, and moans; his eyes red, his ſkin very hot and dry, and his breathing frequent and difficult. When the diſeaſe has made ſome progreſs, expiration is always followed with a conſiderable depreſſion of the flanks; there is a frequent cough; the breath is very fetid; the heart and arteries beat violently; the tongue and palate are dry and become blackiſh; the animal loſes his appetite and ceaſes to chew the cud; there is conſiderable thirſt; the urine is ſcanty, reddiſh, and the excrement hard and blackiſh towards the beginning of the diſeaſe, and ſometimes limpid and bloody. Cows loſe their milk. On moſt of the animals inflammatory tumours are produced, which appear ſometimes on the cheſt, ſometimes on the vertebræ of the neck, and on the belly; at others on the udder, and the parts of generation. At other times they entirely cover the ſkin in pimples, like thoſe of the mange or ſcab.

All theſe ſymptoms do not often appear on the ſame ſubject; but in proportion as more of them occur, the diſeaſe is the more fatal. In general, death takes place on the fourth day, when the ſymptoms are violent; if they paſs the fourth day, and are not worſe on the ſeventh, their recovery is pretty certain, though they are often not convaleſcent before the fifteenth day.

When the urine is turbid, and depoſits a whitiſh ſediment; when the excrements are more abundant than in the natural ſtate, moiſt and not very offenſive; when the ſkin is black and relaxed, the pimples filled with whitiſh matter, the thirſt alleviated; when the appetite and rumination returns, and when the puſtules begin to dry up, a perfect recovery may be expected: but on the contrary, when there is much ſwelling of the belly, when the animals moan much, when there appear great debility, tremblings, convulſions, retenſion of urine, diarrhœa or dyſentery, a fatal termination may be looked for. Diſeaſes.

On opening the bodies of ſuch animals as died of this diſeaſe, there appear on the ſkin numerous black tumours, full of a yellow ſerous fluid that effervesces with acids; the muſcles are livid, ſoft and flaccid; the lungs waſted, full of tubercles and little ulcers, eſpecially on thoſe animals which died on the fourth day. The ſtomach and bowels are beſet with red tumours, full of a tenacious clammy fluid.

M. Reynier conſiders the predispoſing cauſes of this diſeaſe to be the bad quality of the water which the beaſts drank, the corrupted ſtate of their food, exceſſive fatigue, low and ill-aired ſtables, deficiency of herbage, and tempeſtuous weather. Like many other medical men of his time, he held the immediate cauſe of the diſeaſe to conſiſt in an alkaleſcent ſtate of the blood. The method of cure conſiſted in giving drenches of emollient decoctions, clyſters of the ſame ſubſtances, with nitre and vinegar mixed with honey; and towards the latter ſtage of the diſeaſe, the Peruvian bark and camphor were adminiſtered. This was a very *innocent* and *gentle* treatment, and it is no wonder that ſo many of the cattle died.

6. Strangles.

481 Strangles.

The diſeaſe called *ſtrangles* in horſes, is conſidered by Mr Blaine as a ſpecific fever, accompanied with a diſpoſition to inflammation in the glands of the head and throat. It moſt commonly attacks horſes betwixt four and ſix years of age, though it may occur at any period before ſix; but rarely appears after that age. Young horſes are moſt ſubject to it when firſt brought to labour, and put on the nouriſhing diet of the ſtable, though Mr Lawrence has ſeen it in unbroken colts in the field. It ſeems that few horſes eſcape having it once in their life.

It commences with a conſiderable degree of fever; the breath is hot, the eyes are heavy and languid, the horſe thruſts out his noſe, has a hoarſe cough, and labours under ſome difficulty in ſwallowing. There ſoon appears a ſwelling between the jaws, or on the inſide of the lower jaw, which uſually extends to the parotid glands. Theſe ſwellings, if left to themſelves, go on to ſuppuration; and about the fifth or ſixth day they break and diſcharge a conſiderable quantity of matter; but ſometimes the heat, hardneſs, and ſwelling of the glands continue for a long time. Theſe ſymptoms are uſually attended with a running at the noſe, which is conſidered as a favourable ſign.

This complaint is ſeldom dangerous, though now and then there is ſome riſk of ſuffocation, and ſometimes it degenerates into glanders. Of this Mr Lawrence has ſeen ſeveral inſtances. It appears to be contagious, and may be propagated by inoculation, which has induced us to conſider it among the febrile eruptions.

The writers on farriery have ſtrangely differed with reſpect to the nature of this affection. The elder Lafoſſe conſidered it as analogous to the ſmallpox. Bracken as a ſpecies of *cynanche*, or *quinſey*, and it certainly nearly reſembles the *cynanche parotidea*, or *mumps*. Others have ſuppoſed it to be like the chickenpox, or meaſles.

It is not agreed on whether it is better to check the inflammation

Diſeaſes. inflammation of the glands, or to encourage their ſuppuration. Mr Blaine recommends the former plan, which is beſt effected by bleeding, purging, and the uſe of diuretics; while a ſolution of ſugar of lead is applied to the ſwelling externally; but if the ſwellings continue hard and hot, it will be proper to encourage ſuppuration by the frequent application of warm poultices. If there is much ſoreneſs and ſwelling of the throat, a large bliſter ſhould be applied to it. If there is much fever, nitre or emetic tartar may be added to the horſe's water; for it would be wrong to give him medicine in the form of a ball or drench. He may have frequent warm maſhes; and to encourage the running at the noſe, there ſhould be hung to it a bag containing a warm maſh, which ſhould be frequently renewed. The horſe's head ſhould be kept warm, and currents of cold air ſhould be avoided. When the tumours break, the diſcharge ſhould be aſſiſted by enlarging the opening and applying warm poultices, and the ulcers may be dreſſed with the common digeſtive ointment. If the diſcharge proceeds by the mouth, the parts ſhould be frequently waſhed with vinegar and water ſweetened with honey.

5. GREASE. Eaux aux Jambes, Fr. *Greaſy heels.*

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Greaſe. In the fourth chapter of the laſt ſection, N° 423. we made a few obſervations on ſwelling of the legs, and we remarked that this complaint often terminated in greaſe.

Greaſe is a complaint that is extremely common among horſes, to whom it is peculiar, not being known to affect any other ſpecies of animals, or at leaſt there is no other animal in whom that peculiar ſecretion which conſtitutes the matter of greaſe in horſes is found to take place. There appears to be two varieties of greaſe, the one a mere local affection, the other a more general affection of the ſyſtem attended with fever.

The complaint firſt appears by a ſlight ſwelling about the coronet and paſtern, ſometimes accompanied with pain or itching, ſo that the horſe rubs his feet againſt each other, or ſtamps and ſhifts himſelf from ſide to ſide. On feeling the ſwelled part, it is commonly found much hotter than uſual, and is evidently red and inflamed. Very ſoon there may be perceived an oozing through the ſkin, of a yelloviſh fluid that is very offenſive, and of an unctuous greaſy feel. This ſwelling gradually extends up the cannon towards the knee, and when the horſe is taken out to work, he appears ſtiff and lame till he becomes heated; and when he returns from work, the leg appears hot and inflamed. The ſwelling and oozing of fetid greaſy fluid gradually increaſe till cracks begin to make their appearance in the ſkin about the heels, the hairs about theſe parts fall off, and the ſkin below appears puffy, of a whitiſh or livid colour; and on it are generally ſeen little bladders, from which a matter of the ſame kind as what we have deſcribed oozes out. Theſe veſicles ſoon become ulcers, and the matter they contain aſſumes the appearance of pus, which irritates and inflames the neighbouring parts, fretting and excoriating the ſkin. Generally a number of red granulations or excreſcences appear within the ulcers, and from their form are commonly called *grapes*; and if the complaint continues long, the hoof becomes fungous, or there is a luxuriant growth of ſoft ſpongy horn. If the complaint be neglected, the ulceration of the part increaſes, and extends even to the bones, which become ſoft, ſpongy, and at laſt carious. Diſeaſes.

In what is called the confirmed ſtate of greaſe, the affected parts are exquiſitely ſenſible, and they bleed on the ſlighteſt touch, and there are commonly produced a number of horny excreſcences about the fetlock. The hair ſtands erect, and the horſe becomes lean, weak, and exceſſively irritable.

Such are the general appearances and progreſs of greaſe; but there are often ſome little varieties in both. Sometimes the cracks appear very early in the diſeaſe, and ſometimes there is conſiderable fever; but whether this precedes the appearance of the veſicles, or is occaſioned only by the pain and irritation that accompany the complaint, we are uncertain. It ſhould ſeem, from the obſervations of Dr Loy and others, that a fever, ſuch as accompanies eruptive diſeaſes, frequently attends greaſe; and in this caſe, as we have ſaid, it is to be conſidered as a general affection. It is deſcribed as ſuch by Huzard, and other continental writers; and they even ſpeak of the appearances that have been found on diſſection of horſes that have died when affected with this complaint, of the repercuſſion of the eruption from cold, &c. On the other hand, there is no doubt that fever may be excited by the irritation of the parts, eſpecially if the horſe is obliged to work. It may take place in any of the legs, but is more common in the hind legs.

Such horſes as have round fleſhy legs, ſuch as have white hair upon their legs, and in general, ſuch horſes as are weak and phlegmatic, are more ſubject than others to greaſe.

It may be brought on by various cauſes. It is very commonly produced by allowing horſes to ſtand long idle in the ſtable. In this way the circulation, which is naturally more languid in the legs, eſpecially in the hinder legs, than in other parts of the body, becomes ſo languid in the heels, that the veins cannot readily propel forward their contents, and conſequently an accumulation takes place in the minute capillary branches; whence ſwelling and inflammation. This accumulation is aſſiſted by the perpendicular ſituation of the legs, by which a column of blood, that for want of the action of the muſcles is moved with difficulty, continually preſſes on the lower parts. Hence we find, that when horſes are not allowed to ſtretch themſelves at their eaſe, they are extremely ſubject to ſwelled legs and greaſe. The languid circulation is ſtill greater in horſes that are naturally of a weak conſtitution, or who have been debilitated by diſeaſe. So great is the effect of diminiſhed exerciſe in producing ſwelled legs and greaſe, that ſome horſes are always affected with this complaint when brought into the ſtable, and can be preſerved from it, only by being regularly turned out into the field after work. It is very commonly obſerved, that when horſes firſt come up from paſture, or from a ſtraw yard, they are all more or leſs affected with ſwelled legs; and if theſe are not diligently attended to, they ſoon have greaſy heels. It is certain that horſes in their natural ſtate, or while kept conſtantly at paſture, are never affected with greaſe.

Sudden changes from heat to cold, or *vice verſa*, frequently produce this complaint; but, according to Mr Feron, it is more commonly produced by ſudden changes

Diſeaſes. changes from cold to heat. "If (ſays he) a colt is taken from graſs, and immediately kept in a warm ſtable, after having been uſed to the ſeverity of the atmoſphere, he then gets the diſorder. When old horſes are troubled with the greaſe, we ſhall find that their feet have been expoſed firſt to cold, and afterwards to heat, as when they have been in cold water or ſnow for a long time, and on coming into the ſtable have a large bed of ſtraw, or perhaps hot dung, to ſtand upon. This ſudden tranſition from cold to heat, produces a weakneſs in the legs, particularly in the ſkin; when inflammation and cracks, ſimilar to chilblains in the human ſubject, take place, and are called the greaſe in horſes."

Nothing contributes more to the production of greaſe than negligence, with reſpect to keeping the legs clean, and rubbing them often. It is a diſputed point, whether the hair that grows about the fetlock is prejudicial or not to horſes that are ſubject to greaſe. It is contended by Mr Richard Lawrence, that greaſe is a very common conſequence of removing the hair; and conſidering that the hair is a good preſervative againſt ſudden tranſitions from heat to cold, we are diſpoſed to think its removal improper, where the heels are not already ulcerated. On the other hand, Mr Blaine remarks, that whenever accidental wet occurs, this hair muſt retain a large quantity of it, and hence be long in drying, occaſioning a copious evaporation, and thus producing much cold, and that the hair renders it difficult to keep the legs ſo clean, as they might be preſerved without it. Even ſuppoſing theſe arguments to be juſt, they only ſhow the neceſſity of greater care and attention in rubbing the heels dry and keeping the hair free from dirt.

Greaſe may alſo be produced by too much hard work, after which the legs ſwell, and if the ſwelling be neglected the heels may become greaſy. This, however, is probably not a very common cauſe.

Greaſe is ſaid to be moſt common in ſpring and autumn, when horſes are moulting or caſting their coats.

On the whole, it appears that this complaint may take place in two different ſtates of the body; a ſtate of general weakneſs, the effect of conſtitution or diſeaſe; and a ſtate of plethora, attended with a proportional languid circulation in the veſſels of the legs or feet.

In the treatment of greaſe, we muſt conſider whether it be merely a local affection, or be connected with ſome general morbid affection of the body; and we muſt alſo attend to the ſtate of the affection, as the nature of the local applications will depend much on the progreſs that the diſeaſe has made.

In the early ſtage of the complaint, when the inflammation is ſlight, and the ſkin is not yet broken, if it has been owing to want of exerciſe and plethora, it may be proper to draw blood from the veins of the thighs, and a diuretic ball, ſuch as N° 12. or 13. ſhould be given, and repeated every two or three days. The hair muſt be cut cloſe, and the heels well waſhed with warm ſoap and water, after which they muſt be gently rubbed till they are perfectly dry, and bathed with ſome ſtimulating liniment. This plan, with gentle exerciſe and a cooling diet, eſpecially bran mathes, with an ounce of nitre in each, every night, will probably prevent the complaint from going any farther. If the inflammation be very conſiderable, and the horſe is plethoric, he muſt be bled pretty largely from the jugular vein, and have a mild purge. Cloths, dipped in vinegar and water, or in a ſolution of ſugar of lead, ſhould be applied to the heels after waſhing, and kept conſtantly moiſt with the ſame liquor. More than walking exerciſe here will be improper; but if it is dry weather, a run for a few hours a-day in a field will greatly contribute to removing the ſwelling. Mr Feron, who is a great advocate for warm fomentations in inflammatory affections of the feet and legs, recommends the legs to be kept the whole day in warm water; and when they are taken from the bath, to be well wrapt up in a warm poultice of bran and water. If by theſe means the inflammation ſubſides, the legs may be waſhed with a ſolution of alum. Diſeaſes.

If cracks appear, great attention muſt be paid to keep them clean from dirt, and they ſhould be frequently waſhed with a ſolution of blue vitriol. If grapes appear, they may be touched with blue vitriol, or burnt alum; or if they become large, they muſt be cut away with a ſharp knife, and afterwards ſeared with a hot iron. If the ulcers are foul, one of the beſt applications will be a ſolution of verdigriſe, or the ointment commonly called *Egyptiacum*, of which verdigriſe forms one of the principal ingredients.

The ſtricteſt attention to diet, regimen, and cleanlineſs, muſt be obſerved during the whole treatment, and gentle exerciſe muſt be perſiſted in. The beſt diet on theſe occaſions will be cut graſs, lucerne, freſh clover, carrots, or good ſweet hay, and an occaſional feed of corn. The horſe ſhould not be tied up in the ſtall, but ſhould ſtand looſe while he is in the ſtable, and ſhould be allowed no litter, except at night. The ſtable ſhould be kept perfectly clean and well aired, and not too warm.

Sometimes, even though the complaint ſhould not at firſt have originated in debility, there will, if the diſeaſe is of long ſtanding, be produced a conſiderable degree of weakneſs. In theſe caſes the cure will be greatly aſſiſted by giving ſtrengthening remedies, ſuch as bark, horſe-cheſnut bark, &c. And as in this weak ſtate of the body the diſcharge from the ulcerated ſurface is commonly thin and ichorous, the ſore muſt be dreſſed with ſtimulating ointment; and if there appears a tendency to mortification, as ſometimes happens, a powder of equal parts of Peruvian bark and opium ſhould be ſprinkled on the ſores, before applying the plaſter. If the diſcharge is very offenſive, a fermenting poultice, ſuch as N° 64. may be applied over the dreſſings.

It will readily appear, that the beſt means of preventing greaſe, will be to give the horſe regular exerciſe, to dreſs him well, and eſpecially to keep his legs dry and clean, and to avoid the extremes of heat and cold.

Greaſe might perhaps have been conſidered under the head of ſpecific inflammation; but as it is ſometimes attended with a general affection of the body, and is ultimately connected with one of the moſt intereſting eruptive diſeaſes, we thought it beſt to treat of it in this place.

CHAP.

Chap. II. *Of Inflammatory Diſeaſes.*

1. Inflammation of the Brain. Phrenitis. *Mad Staggers, Phrenzy, Megrim,* or *Sough.* Mal de feu ou d'Eſpagne, Fr.

483 Inflammation of the brain.

This is one of the moſt ſerious and fatal inflammations which affect the animal ſyſtem. It attacks occaſionally all the domeſtic animals, but horſes and cattle are the moſt ſubject to it. In the former it is generally called the *mad ſtaggers*, to diſtinguiſh it from apoplexy, or ſleepy ſtaggers; when it occurs in cattle, it uſually takes one of the other names which we have given as ſynonyms.

Inflammation of the brain is ſometimes preceded by giddineſs and partial blindneſs; the animal holds his head low, or reſts it againſt the manger; he appears dull, heavy, and ſleepy; gradually, however, theſe ſymptoms go off, and are ſucceeded by others of a very different nature. His eyes appear red, fiery, and ſparkling; he now holds his head higher, and appears for ſome time to look conſtantly at any object before him; ſoon he becomes very reſtleſs, till by degrees he is quite unmanageable. He ſometimes lies down, and tumbles about, and then remains quiet for a while; but he ſoon gets up again, and is as ungovernable as before, rendering it dangerous for any perſon to approach him. The pulſe in this diſeaſe is full and hard, and there is conſiderable throbbing of the temporal arteries. The pulſe is not always the ſame in every caſe, being in general leſs frequent than in health, but ſometimes more ſo. There is always a conſiderable degree of fever, and the head ſeems peculiarly affected. The ſecretions and excretions are generally diminiſhed, but it is ſaid that they are ſometimes increaſed.

Such are the ſymptoms as they generally appear in the horſe; thoſe which take place in cattle, as they are deſcribed in the beſt books on the ſubject of cattle medicine, differ in a few particulars.

The animal is deſcribed as looking frightfully, being unuſually watchful, ſtarting often, groaning vehemently, as if affected with ſudden and violent pain; his reſpiration ſlow, but he ſometimes makes very long inſpirations, and appears for a time as if his breathing was entirely ſuſpended. Suddenly the beaſt will riſe, turn about, and inſtantly lie down again, ſhowing marks of great reſtleſſneſs and delirium. When the frenzy is high, the eyes look red and furious; at other times they border on languor and ſtupefaction; but the beaſt always appears to labour under conſiderable fear, and dreads the approach of every thing; he is often quite ungovernable, and ſcarcely ever inclines to reſt, except in the latter ſtage of the diſeaſe, when, if it has been neglected, or has not yielded to the uſual remedies, a lethargy takes place, and the animal ſinks. Sometimes the urine is hot and high-coloured; but it is ſaid that before a fit of phrenzy takes place, the urine is often of a pale colour, and thinner than natural.

When the ſymptoms of fury or irritation ſuddenly ceaſe, and a lethargy takes place, while the pulſe becomes feeble, and the ſtrength diminiſhes, the caſe is pretty certainly hopeleſs; but if the fever, redneſs, and ſluſhing of the eyes gradually ſubſide, without the pulſe ſinking, or great debility coming on, the beaſt may generally be pronounced recovering.

On opening the head of ſuch animals as have died of this complaint, very evident marks of inflammation appear about the membranes of the brain, and very frequently in the ſubſtance of the brain itſelf. All the veſſels are turgid with blood; and on cutting into the brain, innumerable little red points are to be ſeen, which do not appear in the natural ſtate. Very commonly an effuſion of blood, or of purulent matter, is found to have taken place into the cavities of the brain, or in ſome part near its ſurface.

The cauſes of inflammation of the brain are generally the ſame that produce inflammatory fever, applied in a greater degree; as great heat, exceſſive exerciſe, a ſudden change from a poor to a rich diet.

The cure of this complaint requires the moſt prompt and deciſive meaſures. Blood muſt be taken in large quantities from the jugular vein or temporal artery. Not leſs than three quarts ſhould be taken from an ordinary horſe, ox, or cow; and if the animal is very large, four may be taken; and the bleeding muſt be repeated a few hours after, if the ſymptoms do not abate. When the beaſt is very furious, it is often dangerous to bleed in a very deliberate way; but as his recovery will almoſt certainly depend on a ſufficient loſs of blood in the early part of the diſeaſe, it will not be amiſs to bleed him in the manner deſcribed by Mr Blaine, as having been practiſed by an eminent veterinary ſurgeon, who being called to a horſe affected with ſtaggers, and in ſuch a ſtate of delirium that none of the ordinary precautions for ſecuring him could be adopted, plunged a lancet into each jugular, and permitted the animal to bleed till he fainted, by which means, though the diſeaſe was far advanced, he ſaved the horſe. After bleeding, a ſtimulant bliſter ſhould be applied to the top of the head, and the ſides of the neck ſhould be well rubbed with a mixture of powdered cantharides and oil of turpentine, and other means uſed to promote external inflammation, for the purpoſe of determining the blood from the head. Mr Coleman is ſaid to recommend in theſe caſes the pouring of boiling water on the paſterns, by which means bliſtering will ſpeedily be produced in thoſe parts. In deſperate caſes the determination of blood to the head may be moſt effectually ſtopped, by tying a ligature about one of the external carotid arteries; but in doing this great care muſt be taken not to include within the ligature the nerves that run near the artery, as theſe nerves are the principal branches that ſupply the ſtomach; and if they be included in the ligature, the functions of that organ will be in a great meaſure deſtroyed. In addition to theſe means coſtiveneſs muſt be carefully guarded againſt. After back-raking, a ſtimulating purging clyſter ſhould be injected as ſoon as poſſible, and if an interval of quiet will permit, a purging ball, ſuch as N° 15. may be given by the mouth. If the above means are adopted in proper time, the animal will generally be ſaved; but if ſome days have elapſed before vigorous ſteps are taken, there can be little hope of a cure.

Mr Downing, in his work on cattle-doctoring, mentioned in N° 87, adviſes a method of treating inflammation of the brain in cattle, that is extremely contradictory and inconſiſtent. He at firſt very properly adviſes bleeding; but he directs this to be followed by giving diapente, a very powerful cordial medicine, the adminiſtration of which completely counteracts the effects of the bleeding. *Dr* Downing deſcribes a fever of the

Diſeaſes. brain as diſtinct from inflammation; and he then treats of a ſleepy fever. Theſe are evidently ſymptomatic affections, and ſhould have been given as ſuch, as well as giddineſs, or ſwimming in the head, which is deſcribed by *Dr* Downing "as a diſtemper belonging to the cavities of the eyes and optic nerves. It gives a wavering motion to the body. For if the optic nerve, or its expanſion on the bottom of the eye called *retina*, be agitated by any preternatural heat or other emotion, objects will change their ſituation; therefore, this diſeaſe is a fever affecting the cavities of the eyes, or the optic nerves."

2. INFLAMMATION of the EYE. Ophthalmia Membranarum. *Moon-blindneſs.*

484 Inflammation of the eye.

Though in the human ſubject there are ſeveral ſpecies of ophthalmia, in the horſe there is but one, which is in a great meaſure ſynonymous to what has been called *ophthalmia membranarum* by medical writers. This diſeaſe in the horſe is of conſiderable importance, as it is not merely a local diſeaſe, but appears to be connected with ſome conſtitutional affection. Before we deſcribe the ſymptoms and treatment of this complaint, it will be proper to remark, that in the eye of the horſe there is a firm cartilaginous ſubſtance, ſituated at the inner corner of the eye, the greater part of which is hidden by the eyelids, but a ſmall portion projects beyond them, and may be diſtinguiſhed by its black colour. This is commonly called the *haw*, and by anatomiſts the *membrana nictitans*, and is ſuppoſed to be a production of the retractor muſcle. Our reaſon for mentioning this part will appear immediately.

Inflammation of the eye ſometimes makes its appearance very ſuddenly; at others it is gradual in its attack. In general, one of the earlieſt ſymptoms of it is a ſwelling of the eyelids, eſpecially of the upper, which is with difficulty held open; the eyes water conſiderably, and drops of tears may be ſeen at the extremity of the lachrymal duct, which do not appear in the healthy ſtate of the eye. The external tranſparent parts of the eye become diſcoloured and obſcured, appearing of a blackiſh glaſſy hue; ſometimes of a dull white, at others brown or bluiſh. Red veſſels may be ſeen running over the white of the eye, eſpecially at the corners, and ſometimes reaching to the centre of the eye. The cornea is ſaid to be moſt obſcured on its upper part; but this is probably owing to the ſituation of the perſon who looks at the eye, who being below it, ſees directly through the lower part of the cornea, and but obliquely through the upper. When the eyes are in this ſtate, the horſe is very impatient of light, and holds his head down to guard againſt it. The eyelids and ball of the eye are evidently much hotter than uſual, and ſometimes there may be ſeen through the cornea, a ſmall quantity of thickiſh matter like *pus*, in the lower part of the anterior chamber of the eye. The cartilaginous membrane or *haw* is now much more viſible, and projects forward conſiderably outward from the corner of the eye.

It not unfrequently happens, when the diſeaſe has not proceeded farther than we have deſcribed, that it gradually, ſometimes pretty ſuddenly, diſappears, and is ſeen again in the courſe of a few weeks, although ſometimes it comes back in the courſe of a few days. The diſappearance of inflammation in the eye of the horſe is ſometimes ſo ſudden, that the eye, which one day is conſiderably inflamed, will appear the next perfectly clear and healthy. Sometimes it ſeems to appear and diſappear periodically; and it has been ſuppoſed by ignorant people, that in theſe periods it follows the changes of the moon, whence it has received the name of *lunatic blindneſs*. If the diſeaſe does not thus diſappear, or if it appears again, and reaches the height before deſcribed, the inflammation goes on, and the cornea becomes more obſcure; or, what very frequently happens, the cornea recovers its tranſparency, and the cryſtalline humour becomes opaque, forming the diſeaſe already ſpoken of in N° 325. Diſeaſes.

In the horſe, one eye frequently only is affected, whereas in man, both eyes are generally inflamed at the ſame time. This diſeaſe more frequently occurs in young horſes of five or ſix years old, than in thoſe of a more advanced period. It is ſaid that horſes are never affected with inflammation of the eyes till they are broken, or taken up from the paſture where they have remained from their birth.

A plethoric ſtate of the body ſeems very much to prediſpoſe to inflammation of the eye, and this ſeems to account for its occurring ſo frequently in horſes of five or ſix years old, as at that age they generally ceaſe to grow, and are, of courſe, more diſpoſed than at other times to fulneſs of blood. Sudden changes of temperature form a very common exciting cauſe of this diſeaſe, and the heat and foul air of a cloſe ſtable frequently produce it. Such horſes as are kept in dark ſtables are alſo more ſubject to it, from the effect of ſudden expoſure to broad day-light. Want of exerciſe, or extremes of idleneſs and hard work, may alſo aſſiſt in producing it. Mr Coleman conſiders this diſeaſe in the horſe as an inflammation of a ſpecific nature, very different from any that occurs in other animals. The principal reaſons for ſuppoſing that the conſtitution is affected are, that a horſe affected with an inflammation of the eye either does not perſpire, or ſweats profuſely, indicating a ſlow fever. If the animal is bled or purged, the eye ſpeedily becomes clear; and if the ſame cauſes are applied, the ſame eye, or more commonly the other, becomes inflamed, and ſometimes the diſeaſe appears alternately in each eye.

Provided the proper means be taken in the early ſtage of the diſeaſe, the inflammation is commonly ſoon removed; but when the cryſtalline humour becomes opaque, no means hitherto employed have, as we ſhall preſently ſee, produced any benefit.

In the treatment of this affection, it muſt be remembered, that the conſtitution is deranged, and that our remedies muſt therefore not be confined to local applications to the eye. General blood-letting will almoſt always be required; but, unleſs the horſe is very fat or plethoric, this need not be repeated. It will be proper alſo to apply a bliſter or two to the head, as near the eye as poſſible, and the veins at the corners of the eye ſhould be opened, to draw blood from that part. The horſe muſt be put on lower diet, and ſhould uſe only very moderate exerciſe; the ſtable ſhould be kept well aired and cool; and if the horſe's eyes are very ſenſible, and the ſtable happen to have windows, theſe ſhould be darkened. It will generally be adviſable to give a purgative medicine; and the horſe may drink frequently of ſome cooling liquor, eſpecially of water, with nitre diſſolved in it. Rowels have been ſometimes recommended; and it is ſaid that conſiderable benefit has

Diſeaſes. has followed the inſertion of ſetons as near the eye as poſſible. They have ſometimes been paſſed through the white of the eye, juſt below the tranſparent cornea; but to this we ſhould object, as being liable to produce ſpecks that may extend to the cornea. As there is generally conſiderable dryneſs of the ſkin in this complaint, it may be uſeful in ſome caſes to adminiſter a gentle ſudorific, ſuch as a ſolution of two drachms of emetic tartar, or N° 22. of the receipts may be given.

With reſpect to the applications to the eye itſelf, thoſe which appear the moſt likely to be of advantage, are ſtimulating ſubſtances, ſuch as tincture of opium, ſolution of blue vitriol, red precipitate in the form of a ſoft ointment, ſuch as N° 40. Sometimes, however, theſe ſtimulating applications do harm; and it is found that a weak ſolution of ſugar of lead, or acetate of zinc, as preſcribed in N° 31. are moſt uſeful. We muſt here take notice of an abſurd practice that is in uſe among common farriers, of cutting away the *haw*, which they conſider as a very principal part of the complaint. There is no doubt, however, that relief may have been procured by this operation, as it will generally be attended with a pretty copious effuſion of blood, that will relieve the diſtended veſſels; but as this effuſion can be more eaſily produced by ſcarifying the red veſſels of the white of the eye; and, by opening the angular veins, there is no occaſion to take away a part, which is certainly of conſiderable uſe to the animal.

Sheep are ſometimes affected with inflammation of the eye; but in them, as in moſt other animals, it is merely a local diſeaſe, and is generally relieved by topical bleeding. In the corrected agricultural report of Perth, it is ſtated, that the common practice in that diſtrict for relieving inflammation in the eyes of ſheep is, to open the veins in the corner of the eye, and hold down the animal's head, ſo as to allow the blood to get within the eye. There is no doubt that this bleeding does good; and the introduction of the blood within the eye may, we believe, alſo be of ſervice; not, however, in the way ſuppoſed by the reporter, but becauſe it acts as a gentle ſtimulus.

We have already, in N° 324. made ſome obſervations on cataract, and noticed the inefficacy of all the uſual methods of treatment. It may not be improper here to add the reſult of Mr Coleman's experimental attempts to relieve this complaint, as ſtated by Mr Feron.

"The profeſſor has begun with bleeding from the jugular or angular veins, and, at the ſame time, employing purgatives frequently repeated, as well as diuretics adminiſtered one after another. After which he has tried all the medicines of Meſſrs Phipps and Wathen, but without any degree of permanent ſucceſs. The local and ſurgical treatment has been as follows, viz.

"1ſt, He has ordered ſcarifications, and to paſs a ſeton through the membrana conjunctiva; but without effect.

"2dly, We have removed ſome of the larger veſſels going to the cornea, and divided them with the actual cautery, but with no ſucceſs.

"3dly, We have applied leeches to the conjunctiva, but without effect.

"Laſtly, We have taken up both carotid arteries, which was of no avail, from the anaſtomoſes, which the vertebral arteries form with them.

"Therefore, the treatment is confined entirely to Diſeaſes.
bleeding, purging, and diuretics; fomentations of warm water, in order to diminiſh the irritation from the tears that run over the cheeks; and plenty of moderate and continual exerciſe, ſo as to increaſe the perſpiration."

3. Catarrh. Catarrhus. *Mor Foundering*, or Common Cold.

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Catarrh, or cold.

Catarrh has been placed by Dr Cullen among the *profluvia*, or fluxes attended with fever; we have ventured, with ſome modern authors, to rank it as an inflammation, becauſe the increaſed ſecretion of mucus, which might entitle it to be called a *profluvium*, though ſometimes pretty conſiderable, is not a conſtant, or often a very remarkable ſymptom of the diſeaſe; and in all caſes appears to be the effect of an inflammatory ſtate of the pituitary membrane. There are generally reckoned two ſpecies of catarrh, ſimple cold, and epidemic catarrh, or *influenza*. Though in the latter of theſe the catarrh is probably only ſymptomatic, we ſhall, in compliance with the uſual cuſtom, conſider it immediately after common catarrh.

This diſeaſe attacks all the domeſtic animals; but horſes and dogs are moſt liable to it, and in them the ſymptoms are moſt ſevere. It uſually commences by a general dulneſs and heavineſs, a dryneſs and increaſed redneſs of the inſide of the noſtrils, from which there ſoon proceeds an unuſual ſecretion of mucus; a dryneſs of the eyes, or ſometimes an increaſed effuſion of tears. In a ſhort time there is generally added ſome degree of cough and difficulty of breathing; and ſometimes there is with theſe ſymptoms a conſiderable degree of heat and dryneſs of the ſkin; increaſed thirſt, and not unfrequently a loſs of appetite. At firſt the cough is dry, and ſometimes continues ſo; but more frequently, when the complaint has remained for ſome time, a frothy whitiſh mucus is coughed up. The pulſe is not always much affected in this diſeaſe; but in general it is fuller and harder than natural. The firſt ſymptom of the diſeaſe is not unfrequently a chilliness and trembling.

The principal cauſes of catarrh in domeſtic animals, as well as in man, are ſudden changes of temperature, eſpecially cold applied when the body is in a ſtate of perſpiration, or entering a warm apartment after having been long expoſed to a cold air. Drinking cold water, when ſweating, is alſo a common cauſe; and theſe cauſes are the more likely to produce their effect when the animal is in a plethoric ſtate.

If neglected, catarrh may go on to inflammation of the lungs; in the horſe it may produce thick wind, or even broken wind; in cattle it may end in chronic cough; and in ſheep it may lay the foundation of conſumption or pulmonic rot. It is alſo not unfrequently followed by the complaint called *glanders*, which we are preſently to deſcribe. An improper mode of treatment, eſpecially giving cordials and other hot medicines, will haſten on theſe terminations of the diſeaſe. If attended to in time, and if the proper mode of treatment be adopted, the ſymptoms are, in general, ſoon removed.

If the complaint is ſlight, and there is little fever, it will often be ſufficient to take the animal within doors into a warm ſtable, give him a warm maſh, and put a cloth over him, when he will perſpire through the night.

Diſeaſes. night, and be nearly well next morning. This plan will alſo anſwer, if it be adopted immediately, on perceiving the chilline ſs or ſhivering. If, however, conſiderable fever has taken place, and the animal's pulſe is hard, it will be proper to draw blood, according to the urgency of the ſymptoms, before giving any internal remedy, or uſing warm clothing. After bleeding, a drench, compoſed of warm ale, with a drachm or two of ſalt of hartſhorn, or half an ounce of ſpirit of hartſhorn ſweetened with molaſſes, will prove an excellent remedy; after taking which, the animal ſhould be well rubbed down, and clothed as before. If the animal is coſtive, back-raking, followed by clyſters, will be adviſable; and throughout the treatment coſtiveneſs muſt be avoided. If there is conſiderable fever, the drench, N° 22. or 26. where coſtiveneſs is to be obviated, ſhould be given every ſix hours. Some practitioners adviſe balls in theſe caſes, as in moſt others; but as there is often ſome ſwelling of the throat, and always conſiderable irritation about the *fauces*, it is better to give the remedies in the form of drenches. The cough ſeldom needs particular attention during the inflammatory ſtate of the diſeaſe, as it will generally go off when the inflammation is removed; if it ſhould continue obſtinate, it becomes a chronic cough, and muſt be treated as directed under N° 436.

4. *Influenza, or Epidemic Catarrh.*

456 Influenza. The epidemic catarrh alſo affects all theſe animals, and has ſometimes been known to attack a whole yard of oxen, horſes, and cows, in one night. It differs from common catarrh in the degree of fever, which, in this complaint, is always very conſiderable, and is one of the firſt ſymptoms. There is a ſmart ſhivering, followed by conſiderable heat and dryneſs of the ſkin, and the fever is commonly attended with great heavineſs and pain of the head, and affection of the eyes. In this complaint there is alſo a great degree of weakneſs, which comes on pretty early in the diſeaſe, and this weakneſs not unfrequently brings on a fatal termination of the diſeaſe. Sometimes there is a conſiderable diſcharge from the noſtrils; at others this diſcharge is either trifling, or the noſtrils are dry, in which caſes the fever is moſt conſiderable.

The epidemic catarrh appears to depend on ſome peculiar ſtate of the atmoſphere; but there is no doubt that it is capable of being propagated by contagion. It is more prevalent in the ſpring, eſpecially when this has been preceded by a mild winter. It is ſaid, that when cattle are at theſe times expoſed to currents of air from the north-eaſt, they are moſt likely to be affected with it.

In the commencement of this diſeaſe, it will be proper to houſe the animals; but too much warmth muſt be avoided, as it would tend to increaſe the weakneſs that forms a principal part of the diſeaſe. It may ſometimes be neceſſary, when the fever runs very high, to draw blood once; and, at any rate, it will be proper to apply a bliſter to the head, or on each ſide the neck. Though warmth muſt be avoided, great care ſhould be taken not to expoſe the animals to a draught of air. Warm maſhes may be given as in common catarrh, but when the fever has ſubſided, cordials and ſtrengthening remedies will be required; and if the appetite is tolerably good, the diet may be more nouriſhing than uſual. The animals ſhould on no account be hard worked, but be allowed to reſt from the time the diſeaſe is firſt noticed, except taking gentle exerciſe when their ſtrength will admit of it. Diſeaſes.

What is commonly called the diſtemper in dogs is now pretty generally conſidered as a ſort of epidemic or contagious catarrh. We ſhall therefore treat of it in this place.

5. *Of the* DISTEMPER *in Dogs.*

457 Diſtemper in dogs. No diſorder is more general among dogs, than that which is generally known by the name of the *diſtemper*; and none is ſo deſtructive. It is aſſerted that, except the plague, no diſeaſe is ſo fatal to the animal which it attacks.

It appears that this diſorder has not been known in Britain, till within the laſt 50 years, but, during that time, it is aſtoniſhing what numbers of dogs have fallen victims to it. For theſe laſt fifteen or twenty years, however, the diſtemper has been leſs frequent, and has aſſumed a milder form.

The ſymptoms of the diſtemper are not alike in every caſe. The following are, according to Mr Blaine, its uſual appearances. It generally begins with a dry huſky cough, attended with dulneſs and want of appetite, a running from the eyes and noſe, and loſs of fleſh. As the diſeaſe advances, the dog appears much emaciated, and grows exceſſively weak, particularly in the loins and hind legs. Convulſive twitchings of different parts, eſpecially of the head, come on, attended with dimneſs of ſight; and, as the diſeaſe proceeds, and puts on a more virulent form, theſe twitchings degenerate into ſtrong convulſive fits, which continue for a long time, and repeatedly return. In theſe fits, the dog foams at the mouth, runs round, and appears to be in great pain, and to have a conſtant deſire to dung. This is ſometimes attended with obſtinate coſtiveneſs, at others with violent purging. The ſtomach is extremely irritable; every thing that the animal takes being immediately thrown up. When the diſeaſe has reached this ſtate, the animal ſeldom recovers, and is uſually carried off in one of the convulſive fits.

In every part of this diſeaſe there prevails a want of energy, and a particular paralytic affection of the nerves. This latter ſymptom, in ſome inſtances, remains long after the diſeaſe has been otherwiſe removed; but, in general, the ſtrength returns almoſt immediately on the removal of the other ſymptoms.

The diſtemper in its worſt form is often miſtaken for canine madneſs; but they may in general be diſtinguiſhed, by attending to the following points.

1ſt, The diſtemper ſeldom occurs except in puppies, its moſt common period being from ſix to twelve months. Madneſs may occur at any age, but ſeldom attacks puppies.

2d, In the diſtemper dogs drink freely; in madneſs, though they often attempt to drink, it does not appear that they are capable of ſwallowing the water.

3d, In the diſtemper the animal does not attempt to bite; but, in madneſs, the propenſity to biting ſeems to be inceſſant.

4th, In madneſs there appears to be a loſs of reaſon at all times, though, as is ſaid, they are ſo ſenſible, as to know their maſter; but, in the diſtemper, though there is ſometimes a loſs of reaſon, it laſts no longer

Diſeaſes. longer than during the continuance of the convulſive fits.

If, therefore, a young dog will drink, as ſoon as the effect of the convulſion is removed, but more particularly when his weakneſs is exceſſive, and ſtrongly apparent in the intervals between the fits, it may be pretty ſafely concluded, that he is affected with the diſtemper, and not with madneſs. Theſe circumſtances, ſays Mr Blaine, ſhould be carefully remarked, as they are unerring, and may ſave many a valuable animal from deſtruction, and many a timid mind from the moſt dreadful apprehenſions.

The cauſe of the diſtemper is difficult to explain; nor do the moſt careful diſſections, in every ſtage of the complaint, aſcertain more than that there is a general inflammation of the mucous membrane: but whether the true ſeat of the diſeaſe is confined to that membrane, and all the other ſymptoms are the conſequences of it, or are real affections of other parts, is an undecided point, although, it is certain that its firſt appearance is by an inflammation of the pituitary membrane, and which is one of moſt laſting, as well as conſtant ſymptoms. That this inflammation is given from the membrane of the noſe, to the upper part of the gullet and wind-pipe, is evident by the ſwelling of the glands of the throat, the tenderneſs and dry cough; and that this inflammation extends from thence to the ſame membrane of the ſtomach and inteſtines, is equally ſo, producing vomiting, coſtiveneſs, or purging. It has generally, as we have ſaid, been conſidered as a ſpecies of *catarrh*; but it has been ſuggeſted to us, by an ingenious friend, that, from ſeveral ſymptoms, as well as from its attacking dogs only once in their lives, it is more analogous to *pertuſſis*, or chincough, in the human ubject.

With reſpect to the cure of the diſtemper, Mr Blaine's directions and remedies appear to have been tolerably ſucceſsful. With the nature of his remedy we are unacquainted, but believe it to be a preparation of mercury. This medicine has been made known by extenſively advertiſing it, and although certificates of its utility are numerous, they make no part of the advertiſement, but are to be ſeen at Mr Booſey's, in Old Bond Street, London, the wholeſale agent; the form is a powder. Explicit inſtructions accompany it; and the price, conſidered with its aſſerted efficacy, bears no proportion, as no ſportſman would think five times the ſum too much for the preſervation of a valuable animal. Although ſo efficacious, it is nevertheleſs innocent enough for a child to take; nor muſt thoſe who are advocates for ſtrong remedies imagine, that, becauſe the effects of this ſhake not the whole conſtitution, that the diſeaſe will not be eradicated by it. When the diſorder is ſtrong, after it is given, there is for the moſt part a gradual decreaſe of the ſymptoms, and nothing but a ſmall moiſture at the noſe remains, which ſpeedily diſappears the next day. If the attack is ſlight, no more is ſeen of it, and the animal is at once well.

From the varieties in the ſize, and conſequent ſtrength of dogs, a difference in the quantity of the medicine is neceſſary; the packets are therefore marked 1, 2, and 3. For a maſtiff, pointer, ſetter, or dog of a large ſize, No. 1. ſhould be procured. Hounds, ſpaniels, and thoſe of a middling ſize, require No. 2.; and all the leſſer dogs, No. 3. Diſeaſes.

It has been already obſerved, that, in the ſeverity of the diſorder, there is frequently ſo great an irritability of the ſtomach, that every thing taken into it is inſtantly thrown up; in ſuch caſes, the powder ſhould be carefully mixed with a ſmall piece of butter, at the ſame time adding to it thirty, forty, or fifty drops of laudanum, according to the age, ſize, and ſtrength of the dog; who is to be watched, whether the medicine is retained, and kept as ſtill as poſſible; but ſhould it be thrown up, notwithſtanding this addition, in two hours after the ſame quantity of laudanum ſhould be given without the powder, in a little broth or milk, and half an hour afterwards the powder mixed into a paſte with treacle, honey, or flour, and thus the vomiting will be prevented. Should there be at the ſame time obſtinate coſtiveneſs, it is probable that ſickneſs may be the conſequence of it, and muſt be removed before it will ceaſe; twenty grains of jalap, or, in preference, fifteen grains of calomel, with four or five drops of laudanum, may be given in a ſmall ball; or two table-ſpoonfuls of caſtor oil may, if more convenient, be uſed. Should theſe not ſtay on the ſtomach, a clyſter with milk, ſalt, and oil, ſeldom fails to remove the coſtiveneſs, after which the powder ſhould be given, if there has been great ſickneſs, with the laudanum; if not, without it.

When, likewiſe, extenſive purging accompanies the complaint, the laudanum ſhould not be omitted; as by running off rapidly by ſtool, the effect of the medicine is equally loſt, as if it were vomited up. In ſuch caſe it will be proper to give before the powder thirty or forty drops of laudanum, with two ounces of olive oil. We ſhould always attempt to remove the ſickneſs and purging, or coſtiveneſs, before adminiſtering the powder, as the effect of this will be then more certain. In the milder form of the diſeaſe, however, nothing is requiſite but to give the powder in ſuch a way, as that the dog may take the whole of it; for which purpoſe the powder ſhould be well mixed with a ſmall quantity of any thing that the dog will eat, or, if he is averſe to eating, it ſhould be made up into a ſmall ball with honey, treacle, or butter, and forced down his throat. It muſt not be mixed with any liquid, as it is ſo heavy that it would fall to the bottom, and thus will probably be loſt. Care ſhould be taken to give the medicine on an empty ſtomach, as the effect will otherwiſe be leſſened or deſtroyed; and the dog ſhould be carefully watched to ſee if the medicine be thrown up, as, if this is the caſe, or if there is reaſon to ſuppoſe that the whole doſe is not given, a ſecond ſhould be adminiſtered. Mr Blaine concludes with obſerving, that the ſymptoms remove without any particular appearance; yet ſo quickly, as that there is ſeldom any remains of the diſeaſe two hours after the medicines have been adminiſtered.

Mr Daniel has witneſſed the extraordinary effects in the diſtemper, from Dr James's powder, given in the following manner. When the ſymptoms of the diſtemper are apparent, a third part of one of the parcels incloſed in the half-crown packets is to be given, mixed with a little butter, and the dog is to have plenty of warm broth, or milk and water, and, if poſſible, he is to be near a fire, or at leaſt kept very warm. Two hours afterwards another third part is to be adminiſtered; and, ſhould neither of theſe operate by vomiting or purging,

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at the end of four hours, give the remaining third. Should the two firſt portions have the effect, the remaining third ſhould not be given until four or ſix hours (according to the evacuations) after the expiration of the four hours; in the interim the dog is to be encouraged to lap, and if he refuſes, be forced to take plentifully of warm broth, or milk and water. Very ſeldom, even when the caſe is inveterate, but the evacuations are brought on by the taking of one packet, generally by the ſecond doſe; but ſhould it ſo happen that there is no ſuch proof of the powder's effect, the ſecond parcel ſhould be divided into ſimilar proportions, and applied in the ſame manner, until the ſtomach is emptied. Warmth and warm liquids will quickly perfect the recovery. As ſoon as the dog's appetite returns, let him be fed (at firſt rather ſparingly) with animal food *.

* *Daniel's Rural Sports.* vol. i.

Dr Darwin adviſes, that the dog be permitted to go about freely in the open air, and have conſtant acceſs to freſh water. The uſe of being as much as may be in the air is evident, becauſe all the air which we breathe paſſes twice over the putrid ſloughs of the mortified parts of the membrane which lines the noſtrils, and the maxillary and frontal cavities; that is, both during inſpiration and expiration, and muſt therefore be loaded with contagious particles. Freſh new milk and freſh broth ſhould be given them very frequently, and they ſhould be ſuffered to go amongſt the graſs, which they ſometimes eat for the purpoſe of an emetic, and, if poſſible, ſhould have acceſs to a running ſtream of water, as the contagious mucus of the noſtrils, both of theſe animals and horſes, generally drops into the water when they attempt to drink. Bits of raw fleſh, if the dog will eat them, are preferred to cooked meat; and from five to ten drops of opium may be given with advantage, when ſymptoms of debility are evident, according to the ſize of the dog, every ſix hours. If ſloughs can be ſeen in the noſtrils, they ſhould be moiſtened twice a day, with a ſolution of ſugar of lead, or of alum, by means of a ſponge fixed on a bit of whalebone, or by a ſyringe. The lotion may be made by diſſolving half an ounce of ſugar of lead in a pint of water *.

* *Darwin's Zoonomia*, v. ii. 4to.

6. Rheumatism.

488 Rheumatiſm.

There ſeems no doubt that horſes, and perhaps cattle, are affected with rheumatiſm, but it is ſometimes difficult to aſcertain the preſence of the complaint, or to diſtinguiſh it from other cauſes that produce lameneſs. It may take place in any of the limbs, but it is more frequently obſerved to affect the hip-joint and the adjacent membranes; and when ſeated here, it is called the *ſciatica*, and ſometimes the *hip-gout*. It will require conſiderable judgment to diſtinguiſh this complaint; but it may generally be known by attentively examining the limb in which the lameneſs is ſeated, from the hip down to the foot, and by attending to the cauſes that ſeem likely to have produced the lameneſs. In rheumatiſm the ſkin will be found dry, and the affected part ſwelled, and the lameneſs attendant on it will be more readily removed by exerciſe than that which has its cauſe ſeated in the foot, or which ariſes from bony excreſcences. Rheumatiſm in the horſe, as in the human ſubject, may be either acute or chronic, and the latter is the moſt obſtinate.

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Rheumatiſm, like catarrh, is produced by ſudden changes of temperature, and by expoſure to a cold moiſt atmoſphere. It is no otherwiſe dangerous than as it renders the animal lame.

The cure of rheumatiſm differs according to its ſtate. In the acute one bleeding may be proper; after which a warm mash, with two drachms of emetic tartar diſſolved in the water, ſhould be given, and the horſe treated as directed under catarrh. If a ſweat is produced, and kept up for ſome hours, the complaint will probably diſappear, and its return may be prevented by frequent friction of the affected part, regular exerciſe, a nouriſhing diet, and attention to avoid changes of temperature. In the chronic rheumatiſm, bleeding will be improper; and the moſt likely means of relief will be, to rub the affected parts ſeveral times a day with ſome ſtimulating liniment, or, if convenient, to uſe the warm bath for a conſiderable time together, or to foment the affected limb for an hour or two every night, after which the limb muſt be rubbed perfectly dry. Pretty conſtant exerciſe will alſo contribute greatly to the cure, and coſtiveneſs muſt be avoided. A bliſter applied over the affected part will ſometimes do good. According to Mr Lawrence, the only cure to be depended on is a month's run of ſalt marſhes in the ſpring, and being continued abroad in ſome ſhady place till autumn, afterwards mercurial phyſic, and the beſt ſtable care.

7. Inflammation of the Lungs. Pleuritis. Peripneumonia. *Pleuriſy. Peripneumony. Riſing of the Lights. Rot.*

489 Inflammation of the lungs.

The lungs are frequently inflamed in the domeſtic animals; and, as in man, the inflammation may be ſeated either in the membrane covering the lungs and lining the cheſt, or the *pleura*, or in the ſubſtance of the lungs, conſtituting the two varieties, *pleuriſy* and *peripneumony*. The diſeaſe has been called by common farriers, *riſing of the lights*, from an idea that the lungs protruded againſt the throat, and cauſed that difficulty of breathing which is one of the principal ſymptoms of this complaint. The other vulgar appellation of *rot* ſeems to owe its origin to the appearance which the lungs ſometimes preſent on diſſection, being found in a ſtate of mortification, and partial decompoſition, as if they were rotten. It is of little conſequence to diſtinguiſh the two varieties of the diſeaſe, as the treatment is the ſame in both.

According to Mr Feron, the ſymptoms of inflammation of the lungs in the horſe are invariably as follow. The reſpiration is quick, the breath hot, the extremities cold, the tongue dry and hot, the flanks heaving, the patient never lying down, which forms a very characteriſtic ſymptom; and ſometimes he hangs down his head. If nothing has been done, it is hardly poſſible to ſave his life, after three days have elapſed; and, after death, the right ſide of the heart is found to have been inflamed, and, on ſome occaſions, ſo much diſtended with blood as actually to burſt, and the lungs are found to reſemble putrid liver, the cells filled with blood, from the great diſtenſion of the pulmonary arteries, and perhaps ſometimes effuſions take place; the pulſe is oppreſſed, from the great diſtenſion occaſioned by the blood in the right ſide of the heart, while the left ſide of that organ is weak, from want of ſufficient blood.

To Mr Feron's account it may be added, that the pulſe,

Diſeaſes. pulſe, at the commencement of the diſeaſe, is generally more full, harder, and more frequent than natural; but, as ſoon as the diſeaſe reaches the ſtage at which it is uſually firſt obſerved, the pulſe has become ſmall and oppreſſed, and but little increaſed in frequency; the veins of the neck are ſwelled and prominent, and the eyes are generally red and ſtarting. There is ſometimes cough, at others none; but the difficulty of breathing is always great, and the horſe ſtands extended, panting for breath, with heaving flanks and open noſtrils, till, no longer able to ſupport himſelf, he drops down and dies. This fatal termination ſometimes takes place in a very ſhort period; in 48, 36, or even 24 hours.

The only diſeaſe with which this can eaſily be confounded, is colic; and the diſcriminating marks will be mentioned when we treat of this diſeaſe. At preſent it will be ſufficient to remark, that when a horſe appears dull, holds his head very low, breathes with difficulty, eſpecially during inſpiration, ſtands conſtantly, has a quick heaving of the flanks, a fullneſs of the eyes, and redneſs of the inſide of the noſtrils, and when the pulſe is ſmall and oppreſſed, he may almoſt certainly be declared affected with inflammation of the lungs.

It may not be improper to give a brief explanation of the ſymptoms which we have enumerated; and they are chiefly to be explained from the difficulty with which the blood paſſes through the lungs, on account of the unuſual accumulation in the pulmonary veſſels. Hence the difficulty of breathing, and the averſion that the horſe expreſſes to lie down; for it is evident, that he will breathe more eaſily in a ſtanding poſture than if he were lying; becauſe, as was remarked in the table of the extremities of the muſcles, ſome of theſe act on the cheſt when the fore legs are fixed, and thus aſſiſt in carrying forward the ribs, and thus increaſing the cavity of the cheſt. The impeded paſſage of the blood through the lungs alſo explains why the pulſe is weak and oppreſſed; and hence, when this obſtruction is relieved by leſſening the quantity of blood, the pulſe never fails to become ſtronger and fuller.

The cauſes of inflammation of the lungs are doubtleſs ſudden changes of temperature, eſpecially when the animal is plethoric; it is probable that the moſt common cauſe is a ſudden change from heat to cold and moiſture. It is at preſent, however, more faſhionable to conſider the reverſe of this as the general cauſe of pulmonary complaints; and we underſtand that Mr Coleman goes ſo far as to ſay, that horſes are never attacked with inflammation of the lungs from expoſure to ſimple cold, for, that the turning of horſes to graſs without preparation, though it may render them emaciated, ſeldom produces the complaint in queſtion. Mr Feron alſo, who may be conſidered as a pupil of the veterinary college, is of opinion, that inflammation of the internal viſcera proceeds from a ſudden tranſition from a cold to a hot temperature, but ſeldom or never from a hot to a cold one. We are aware that theſe gentlemen have borrowed their theory from Dr Beddoes, and it is of little conſequence to our preſent purpoſe, whether it be correct or not.

The judgment to be formed with reſpect to the termination of this diſeaſe, which is always highly dangerous, will depend on the urgency of the ſymptoms, and on the changes that take place after the exhibition of the uſual remedies. If the pulſe becomes fuller and ſtronger after bleeding; if the breathing becomes leſs difficult; if the parts where bliſters have been laid inflame ſoon, and the bliſters riſe well; and, in particular, if the horſe lies down, and ſeems leſs diſtreſſed, we may hope that the danger is leſſened; and if theſe favourable ſigns continue for 24 hours, we may conſider a cure as pretty certain: but, if the pulſe ſtill continues ſmall and oppreſſed, more eſpecially, if it becomes quick and irregular; if the difficulty of breathing continues or increaſes; if there is a rattling in the throat, with partial cold ſweats and extreme dejection; a fatal termination muſt be looked for, which will ſpeedily take place, if the breath becomes cold or fetid. It is conſidered as a very unfavourable ſymptom when the horſe appears inſenſible to external ſtimuli; as when bliſters do not riſe well, nor rowels eaſily ſuppurate. Diſeaſes.

In the cure of inflammation of the lungs, every thing will depend on the ſpeedy adoption of the moſt vigorous meaſures, and the firſt and principal remedy is bleeding. This ſhould be performed as ſoon as poſſible, and to a greater extent than in moſt inflammatory diſeaſes. It will ſcarcely be proper to take leſs than five or perhaps ſix quarts at firſt, and the bleeding muſt be repeated, though leſs copiouſly, ſome hours after, if a conſiderable remiſſion of the ſymptoms does not take place. It muſt not be expected that the pulſe will riſe much after a ſecond or third bleeding; but, if it is not conſiderably weakened, and if the oppreſſed feel of it is removed, we may be ſure that the bleeding has not been carried too far. Another principal means of checking the internal inflammation is, to excite an inflammation externally near the ſeat of the complaint, by every means in our power. A large bliſter ſhould be applied on each ſide of the cheſt, and to the inſide of the fore legs; a rowel ſhould be inſerted below the cheſt, and if the ſymptoms are very urgent, another near the belly. Mr Coleman recommends inflating the cellular membrane below the ſkin with air, ſo as to bring on an inflammation between the ſkin and muſcles; and if this does not ſucceed, he adviſes that ſome ſtimulating fluid, ſuch as oil of turpentine, be injected. We ſhould ſuppoſe this carrying inflammation rather too near the lungs; but from ſome trials that Mr Coleman has made, and ſome others of Mr Feron, this method ſeems to have been attended with conſiderable advantage. In addition to theſe means, the fore legs ſhould be well rubbed two or three times a day with oil of turpentine, or the liniment in No. 42. of the receipts. Theſe are the external means that are chiefly to be relied on; and if theſe be followed up ſpeedily, and with proper attention, there will ſeldom be any occaſion for internal remedies. If theſe be given, they muſt be ſuch as are calculated to cool the body, and check inflammation, ſuch as the drenches No. 22. and 26. eſpecially the latter, as it is neceſſary to keep the bowels open. Perhaps foxglove might here be given with advantage, as directed under that article, at 290. Mr Feron recommends diuretics, and a ball compoſed of *an ounce and half* of emetic tartar, a drachm of opium, and 15 or 20 grains of calomel. We do not know whether this is the practice of the veterinary college, but it appears to us to be inconſiſtent with the bleeding and other evacuants which are generally found moſt ſucceſsful. As coſtiveneſs would tend to increaſe the inflammatory ſymptoms, back-raking and the occaſional uſe of mild clyſters,

Diſeaſes. clyſters, will be requiſite. In general, warm water, or this with a little Glauber ſalt diſſolved in it, will be ſufficient, as all heating purgatives would do harm. The horſe ſhould be kept rather warm, ſhould be clothed, and ſhould drink frequently of warm gruel. Food will not be requiſite, and, if ſet before him, he would probably not touch it. Exerciſe of every kind muſt be avoided, at leaſt ſo long as the inflammatory ſymptoms continue.

The moſt favourable termination of this complaint is by reſolution, when the inflammatory ſymptoms go off without producing ſuppuration or ulceration of the lungs; but ſometimes this ſtate is unavoidable, an ulcer is produced, and, if the matter is not thrown off, it may either produce ſuffocation, or bring on hectic fever and conſumption. When it is found that a cough remains after the inflammation has ſubſided, and a quantity of mucus is thrown off, the evacuation of this ſhould be promoted by gentle expectorants, and the horſe muſt ſtill be kept warm. Though the matter may be completely expectorated, there will generally remain a difficulty of breathing, or thick wind, when inflammation of the lungs terminates by ſuppuration. Sometimes there is left an anaſarcous or dropſical ſtate of the lungs, and in theſe caſes it is ſaid that blue vitriol and turpentine, to the amount of two drachms of each, mixed into a ball, with a proper quantity of linſeed powder, and given every morning, have been beneficial. It may alſo be proper to apply a bliſter over the wind-pipe.

Inflammation of the lungs in cattle differs little in ſymptoms, and nothing in the treatment, from that which we have been deſcribing in the horſe.

490 Pulmonic rot in ſheep.

The lungs of ſheep are very frequently affected with inflammation, which forms one of the diſeaſes that has been confounded under the name of *rot*. It moſt frequently attacks young ſheep, eſpecially thoſe of the more delicate breeds; and it is moſt prevalent in damp paſtures, and during unfavourable ſeaſons. The ſymptoms of this diſeaſe in ſheep have not been well deſcribed, but they probably differ from thoſe in horſes and cattle, only in degree. It does not appear to be ſo ſpeedily fatal, although the animals ſeldom or never recover from it. Towards the latter ſtage of the diſeaſe there is conſiderable weakneſs; and at this time there appears below the jaw an œdematous ſwelling, containing a quantity of fluid, which is eaſily evacuated by piercing the tumour. This tumour is called the *pock* in Scotland. On opening the bodies of ſheep that have died of this ſpecies of rot, the lungs are found full of knots or tubercles, ſimilar to thoſe which appear in human ſubjects that have died of pulmonary conſumption, and ſometimes the lungs appear mortified or rotten. The liver, however, in theſe caſes is found, which diſtinguiſhes this variety from the other diſeaſes called *rot*.

We do not know that this diſeaſe admits of a cure in ſheep, though it might probably be prevented by houſing them, or affording them ſhelter, at thoſe ſeaſons when it is moſt likely to occur.

491 Pleuriſy in dogs.

Inflammation of the lungs occurs ſometimes in dogs, but it does not ſeem to be very frequent in theſe animals. It requires pretty much the ſame treatment as in the horſe, except that here emetic tartar may be given in ſuch a quantity as to excite conſiderable ſickneſs, without vomiting. This would be improper in the horſe, as it would be difficult to regulate the doſe of the medicine, ſo as not to produce ſuch an irritation of the ſtomach as might conſiderably increaſe the animal's diſtreſs, and augment the difficulty of breathing. Diſeaſes.

8. INFLAMMATION of the LIVER. Hepatitis.

492 Inflammation of the liver.

We have no doubt that inflammation of the liver takes place occaſionally in moſt of our domeſtic animals; and it is probably a more frequent diſeaſe than is generally ſuppoſed. Both ſpecies of it, viz. the acute and chronic, may appear in theſe animals, and it will appear preſently, that the latter is a very common diſeaſe among ſheep. Though diſſection has clearly ſhewn, that the liver in cows, horſes, and ſheep, has been affected with inflammation during the life of the animal, yet any account of the ſymptoms of this diſeaſe that is given us by the veterinary writers, is ſo obſcure, that we cannot pretend to give any thing like a perſpicuous hiſtory.

According to Mr Blaine, this diſeaſe, conſidered as a diſtinct affection, is ſeldom met with in the horſe, though, when great abdominal inflammation exiſts, the liver often partakes of the general diſeaſe. In the deſcription of the ſymptoms, this author ſtates that it is uſually accompanied with coſtiveneſs, for the gland ceaſes to ſecrete the bile from its being in an inflamed ſtate; and that bile which was ſecreted, is not poured into the inteſtines, but becomes depoſited in the ſkin, producing jaundice, which is known by the yellowneſs of the eyes and the tongue. The pulſe is generally full, hard, and frequent, but the pain not very intenſe. It would be difficult to detect it, unleſs by the ſymptoms of fever, accompanied with yellowneſs of the mouth and eyes. There would *poſſibly* be pain in the ſhoulder as in the human, in which caſe the horſe might on trial be found lame.

It is eaſy to ſee, that this deſcription is a fanciful picture of the diſeaſe, drawn from the analogy that the author ſuppoſes to exiſt between inflammation of the liver in man and the ſame diſeaſe in horſes; and it is probably not to be depended upon.

The writers on cattle medicine deſcribe the ſymptoms of the diſeaſe in cattle to be a difficulty of breathing, evident marks of fever, yellowneſs of urine, a ſwelling about the ſhort ribs, and an unuſual diſtenſion about the barren or womb. Here the ſymptoms of an acute and chronic diſtemper ſeem to be confounded.

493 Hepatic rot in ſheep.

As for the ſymptoms of the diſeaſe in ſheep, in whom it forms one of the varieties of *rot*, we have ſeen no account of them any further than as they are confounded with thoſe of the other varieties of rot, and, as ſuch, they will be noticed when we come to treat of the rot in general. If this diſeaſe could be detected in its acute ſtate, the cure would probably not be difficult; but when it appears in the chronic form, it is, we believe, ſeldom removed.

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When the bodies of ſuch animals as have died of inflammation of the liver are opened, the liver has been found in various ſtates of diſeaſe; ſometimes it is harder and firmer than uſual, and very frequently there are parts of it that are ſcirrhous and diſcoloured, reſiſting the knife when we attempt to cut through them. Sometimes the biliary ducts are almoſt bony, and there is commonly found in them, and ſometimes in other parts of the liver, a ſpecies of worm called *fluke*; the *faſciola hepatica*

Diſeaſes. *hepatica* of naturaliſts. Sometimes there are ulcers or abſceſſes formed in the liver, and frequently, eſpecially in ſheep, this organ is mortified or decayed.

495 The cauſes of this diſeaſe are very obſcure; in horſes and cattle it is ſaid to be moſt common in hot ſeaſons and warm climates, and that ſuch of theſe animals as are fat are more expoſed to its attacks. It may alſo be brought on by blows or bruiſes on the ſhort ribs, by which the liver may have received ſome injury. In ſheep it is ſaid to be more common in dry weather, eſpecially when the animals have but a ſcanty ſupply of food, and when they are of a coſtive habit. It is ſuppoſed by many, that this ſpecies of rot owes its origin to the flukes that we have deſcribed, as found in the liver after death; but, as theſe flukes have been found in the livers of ſheep that had never been apparently affected with the rot, and, as they are frequently found in the livers of old ſheep, this cauſe is probably rather fanciful; though when theſe animals are very numerous, or when they are ſituated in a very ſenſible part of the liver, they may excite a degree of irritation, and conſequent inflammation, juſt as a great quantity of bots in the ſtomach of horſes have been found to bring on inflammation of that organ.

In attempting the cure of this diſeaſe, when it is aſcertained to be preſent, we muſt conſider whether it is acute or chronic. When it occurs from injuries, it will probably be of the former kind, but in moſt other caſes it will be chronic. Acute inflammation will require bleeding, purging, bliſters, and low diet, as in all other caſes of internal inflammation; but, in chronic hepatitis, the moſt likely remedy is mercury, which may be adminiſtered either internally, in the form of calomel or corroſive ſublimate, or externally rubbed into the ſkin on ſome parts of the animal's body. This mercurial friction may be performed with tolerable eaſe on the ſheep, by pulling off the wool from the inſide of the thighs, and rubbing a drachm or two of the ſtrongeſt mercurial ointment upon theſe parts every night, till the general ſyſtem becomes affected, which may be known by the ſwelling of the gums, offenſiveneſs of the breath, and increaſed flow of ſaliva from the mouth. This, however, would be an expenſive and tedious cure; and if many of the flock appear affected, it would be better to kill them as faſt as poſſible, before the diſeaſe has made ſuch a progreſs as to render the animals lean. If a mercurial courſe ſhould be attempted, the animals ſhould be houſed during the courſe, and ſhould be kept on good nouriſhing food. Coſtiveneſs muſt be avoided in all theſe caſes, by the adminiſtration of gentle clyſters, or occaſional doſes of opening phyſic. A very good medicine, in all caſes of liver complaints, is a ball compoſed of calomel and ſoap, as directed under jaundice, N°

9. Inflammation of the Stomach. Gaſtritis.

496 Inflammation of the ſtomach. The ſtomach may be inflamed, both in horſes and cattle, from various cauſes; but this is a diſeaſe, the exiſtence of which is not eaſily detected. Here alſo Mr Blaine has ſupplied the want of obſerved ſymptoms by analogy, and has ſuppoſed that there would *probably* be unſucceſsful efforts to vomit; and, as the ſtomach is ſo eſſential an organ, the pulſe would *probably* be affected even more than in inflammation of the bowels; that the animal would perhaps point to the left ſide about the tenth or eleventh rib; that there would be great diſtreſs evident in the countenance and manner, and that the loſs of ſtrength would be very great. Diſeaſes.

In cattle there are generally reckoned two ſpecies of inflammation of the ſtomach, one affecting the firſt ſtomach or paunch, and the other the third ſtomach or the manyplies. This latter is commonly denominated *lake-burn*. The ſymptoms of the diſeaſe in theſe animals are alſo very obſcure, but they are probably ſimilar to what have been deſcribed above.

If the reader looks back to N° 409. he will ſee detailed, a caſe that occurred to Mr Clark, in which inflammation of the ſtomach was obſerved, and detected after death; and though the ſymptoms there deſcribed are few, they are *probably* more characteriſtic of the diſeaſe in queſtion, than any imaginary deſcription which we can copy from writers who have never ſeen the complaint.

This diſeaſe is extremely dangerous, and will not admit of a cure, unleſs effectual means are taken at its commencement.

Inflammation of the ſtomach is commonly produced by ſome acrid irritating ſubſtance which the animal has ſwallowed, and this is the effect produced by moſt poiſons. A large quantity of cold water drunk while the animal is in a violent perſpiration, will alſo produce it. It not unfrequently accompanies inflammation of the bowels, which we are immediately to deſcribe. It is ſaid to be ſometimes produced in cattle by the giving of too ſtrong a doſe of aſtringent medicines to cure the red water or bloody urine; and as we have ſeen in N° 409. it may ſometimes be occaſioned by bots.

The diſeaſe can only be cured by very copious bleeding, frequently repeated; by giving mucilaginous drinks, ſuch as water gruel or linſeed tea, applying a large bliſter juſt behind the ſhort ribs, and the frequent adminiſtration of relaxing clyſters. If poiſon has been ſwallowed, we muſt proceed as recommended under N° 407. though in moſt caſes of inflammation of the ſtomach, it will be the moſt humane plan to effect a radical cure by ſhooting the animal through the head, or cutting his throat.

10. Inflammation of the Bowels. Enteritis. *Red Colic. Inflammatory Colic. Dry Braxy in Sheep.* Tranchée Inflammatoire ou Rouge, Fr.

407 Inflammation of the bowels. This is a diſeaſe, to which all the domeſtic animals are ſubject, but it is attended with ſomewhat different ſymptoms, in the ſeveral ſpecies.

It is generally preceded by more or leſs fever. In horſes, the firſt remarkable ſymptoms that appear, are a great degree of reſtleſſneſs, with loſs of appetite, thirſt, with conſiderable heat, and dryneſs of the mouth. The animal evidently labours under violent pain, and is perpetually lying down and getting up again, ſcraping and ſtamping with his feet, with which he ſometimes ſtrikes his belly. When the belly is touched with the hand, the horſe betrays extreme ſenſibility, and ſhrinks from the touch. The pulſe is always increaſed in frequency, and is hard, giving the ſenſation of a cord below the finger. The ſkin feels unuſually hot, all over the body, except at the ears, which are ſaid to be cold. The tongue is commonly covered with a white fur. Coſtiveneſs is almoſt a conſtant ſymptom of this diſeaſe, and

Diſeaſes. till the inflammation is ſubdued, this continues very obſtinate, or, if the animal dungs, it is in very ſmall quantity, and the excrement is very hard. The urine is voided in very ſmall quantities, and with great pain, eſpecially towards the latter period of the diſeaſe. The ſymptoms go on with more or leſs rapidity, till the inflammation is ſubdued by the proper remedies, or till it terminate in the death of the horſe.

Returning health may be expected when the heat of the body gradually leſſens, while the pulſe becomes full, regular, and of the natural frequency, when the horſe dungs freely, and returns to his uſual appetite, and cheerfulneſs. But when there appears a ſudden relief from pain, with a ſoft, feeble, or irregular pulſe, and a purging of offenſive black matter comes on, mortification of the bowels has taken place, and the horſe will expire in a few hours.

On opening the body, evident marks of high inflammation appear in many parts of the bowels, the outer or membranous and muſcular coats of which will be found red, and in ſome parts black. The inflammation is frequently found to have extended to other parts, as the ſtomach, liver, or bladder; to ſome of which the guts will be frequently found adhering. On opening into the cavity of the bowels, theſe will be found greatly diſtended with air, and the great guts loaded with hardened excrement; and ſometimes the inner membrane will appear highly inflamed, or even corroded, ſhewing evident marks of its having ſuffered conſiderable irritation, from ſome acrid ſubſtance.

Inflammation of the bowels is diſtinguiſhed from colic, by the frequency and cord-like feeling of the pulſe, by the preſence of fever, by the tenderneſs of the belly, and by there being little or no remiſſion of the pain. It is ſaid that in colic the horſe rolls much on his back, but is not ſo apt to do this in inflammation of the bowels. It will be ſeen by and by, that a long protracted colic frequently terminates in inflammation.

Inflammation of the bowels may be produced by acrid or poiſonous ſubſtances taken into the ſtomach. It has been ſometimes produced by giving hellebore to horſes, as a purge; and it is ſaid to ariſe ſometimes from giving purgatives at improper times, or in too large a doſe. It is very commonly brought on by giving the horſe cold water, when he is much fatigued, and ſo much overheated, as to be in a profuſe ſweat, or by daſhing cold water upon him, by wading in cold water, or by ſtanding in a draught of cold air, under ſimilar circumſtances of fatigue and ſweating. Coſtiveneſs too long neglected, or entangled rupture, is alſo not an uncommon cauſe.

In the treatment of the inflammation of the bowels, as in all other internal inflammations, we muſt begin with copious and repeated bloodletting, after which a free evacuation of the bowels muſt be attempted by back-raking and the injection of ſoftening clyſters, ſuch as warm water-gruel, mixed with half an Engliſh pint of caſtor oil. All acrid clyſters muſt be avoided, as they will only tend to increaſe the inflammatory affection of the bowels, and even Glauber ſalts and other ſaline purgatives are ſcarcely proper, from the irritation they may produce. After bleeding and evacuating the bowels, warm fomentations applied to the belly may be of ſervice, and the cloths ſhould be applied as hot as poſſible. After the fomentation, the belly may be rubbed with ſome ſtimulating liniment, ſuch as oil of turpentine, or eſſence of muſtard. Firing has been recommended below the belly, as alſo frequent friction with the curry-comb, ſo as to irritate the ſkin, and almoſt make it bleed. Probably no medicine ſhould be given by the mouth, farther than ſoftening, diluting drinks, ſuch as warm water-gruel or linſeed tea. Food at the beginning of the diſeaſe is out of the queſtion; but when the inflammation is a little relieved, the horſe may have a bran maſh. The body ſhould be kept warm by clothing, and all exerciſe ſhould be avoided. Diſeaſes.

Inflammation of the bowels in ſheep is called *dry braxy* in Scotland, and of this diſeaſe we have an excellent account in Mr Findlater's ſurvey of Peebles.

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Dry braxy in ſheep.

This diſeaſe is moſt fatal to young and robuſt ſheep about ſix or ſeven months old, called in many parts of the iſland, *hogs*. It is more deſtructive upon ſome farms than others; and even upon theſe, in one ſeaſon more than another. In a *hog fence*, or paſture capable of keeping 30 ſcore of hogs, there is in ſome years, a loſs from three to four ſcore. This is a very ſerious matter, as each of theſe would ſell in the ſpring, or beginning of ſummer, for half a guinea or 11s. This diſeaſe begins at thoſe times when inflammatory diſorders are moſt apt to prevail, in the months of October and November, and is produced by the common cauſes of inflammation, cold, exertion, external injury, &c. During theſe months, ſlight froſts ſet in, and the ground in the morning is often covered with hoar froſt, or what is called in ſome parts of Scotland *rhine*. It is probable, that eating graſs covered with hoar froſt, may be one cauſe of the diſorder. If ſo, moving the animals about, and preventing them from eating, until the froſt is melted by the ſun, may tend to prevent the diſeaſe.

This diſeaſe runs its courſe very rapidly. When the ſhepherd leaves his flock at night upon their lairs, he ſometimes obſerves a hog look dull, loitering behind, and reſtleſs; ſometimes lying down and ſuddenly getting up again: and in the morning, he will often find it dead, or nearly ſo. At other times he will diſcover no apparent ailment among his flock; and in the morning, he may find one or two dead or dying. From this it appears that the diſeaſe is very acute.

This is further evinced by the appearances after death, when the carcaſes are opened. Their bellies are exceſſively ſwelled, and diſtended with a putrid air: the whole inteſtines being red and inflamed, gangrenous, and in ſome degree mortified. This putrid taint ſeems to be communicated to the whole carcaſe, as all the muſcular parts, and fat, ſmell ſtrongly of corruption. The hogs that die of this diſeaſe, are frequently fat and in good order, which ſhows that the diſeaſe is of ſhort duration.

We have already mentioned the eating of graſs, which is covered with hoar froſt, as a very probable immediate cauſe of this diſorder. But is there any predisposing cauſe?

In anſwer to this queſtion, we ſhall adduce a fact which is well authenticated. Many parts of the weſtern highlands of Scotland, had been for ages occupied by horſes and horned cattle. At the introduction of ſheep into thoſe diſtricts, the beſt graſs was that which had ſprung from the tath and excrements of theſe animals. During many years after theſe diſtricts were converted into ſheep farms, braxy remained unknown. It crept

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Diſeaſes. in at laſt, and the ſeverity of the diſeaſe was long in proportion to the length of time the paſtures had been occupied by ſheep.

From theſe we would infer that paſturing upon their own tath, is a predispoſing cauſe of braxy among ſheep; and that a frequent alteration of the ſpecies of ſtock, upon every ſheep paſture, might ſerve to prevent the evil. This idea correſponds with the general laws of the Supreme Being, who certainly never intended that this earth ſhould be monopolized by any particular ſpecies of animals; but has ſo ordered matters, that the happineſs of individuals ſhall reſult from the happineſs of the whole family of animated beings.

Hence it would appear a beneficial practice in ſtore farmers, in place of one fence, to keep two or more encloſures of this deſcription, and change the ſtock upon them every ſeaſon. This we know to be contrary to general practice, and that what is called the hogs fence, is carefully guarded againſt the intruſion of every other animal.

Lambs, immediately after they are weaned are frequently ſent to poor paſture, which is called *burning* them. Now this appears to be a very bad practice; for the conſequence is, that they fall off conſiderably, before they get at the rich graſs in the hog's fence, of which they eat too freely; and thus become diſpoſed to the diſeaſe treated of. Children, and all domeſticated animals, are carefully fed with nouriſhing food for a conſiderable time after they are weaned; and yet they fall off for ſome time. It would certainly be better to give the lambs the hogs fence at once, and uſe every precaution to prevent them from falling off.

As the diſeaſe is generally advanced to a dangerous height before it is obſerved, we fear that medicine affords but a very faint hope of cure. The diſeaſe being inflammatory, the ſhepherd ſhould attempt to bleed the diſtreſſed creature as ſoon as poſſible; which he can eaſily do, by cutting off part of the tail, or by nicking it underneath, or by cutting off part of the ears. The animal ſhould then be removed to a houſe or ſhed, and attempts made to produce evacuations. In brute animals, it is difficult to produce theſe by medicines adminiſtered by the mouth. The ſpeedieſt and moſt effectual method, is by injections into the rectum or anus. Such injection may conſiſt of a ſmall handful of chamomile flowers, two ſpoonfuls of aniſeſeeds, and as much carraway ſeeds; to be boiled ſlowly in a Scotch mutchkin or Engliſh pint of milk and water, until the half is evaporated. The liquor ſhould then be ſtrained off, and two tea ſpoonfuls of caſtor oil added, or if this is not at hand, the ſame quantity of ſweet oil may be uſed. This ſhould be adminiſtered warm by an injection bag and pipe, or by an elaſtic gum bottle with a pipe properly fitted. Nothing can be eaſier, than to give a ſheep a clyſter in this way; and in all probability it will have a happy effect in evacuating the bowels and procuring relief,

If this does not appear very ſoon, it may be repeated an hour after, and a large ſpoonful of common ſalt added to the former ingredients. If, after all, the animal does not ſeem relieved, another clyſter may be given, conſiſting of a ſmall tea cupful of warm milk and water, to which are added from 20 to 25 drops of laudanum.

As there is a great diſtenſion of the ſtomach and bowels, ariſing from airs or elaſtic vapours, generated in the inteſtines, Mr Walker of Cumberland, in a treatiſe he wrote upon the diſeaſes of brute animals, has ſuggeſted a remedy for this diſorder, which has often proved ſucceſsful in his diſtrict. It conſiſts in puſhing down their throats a flexible tube, ſuch as Dr Monro has recommended, and which has proved ſucceſsful in relieving cows that had over gorged themſelves with red clover early in the ſeaſon (ſee N° 405.). This ſeems a probable means of affording temporary relief, and every ſhepherd that has the care of the hog ſtock, ſhould be furniſhed with one of theſe tubes, adapted to the ſize of the ſheep, for trying the experiment upon thoſe that labour under the diſeaſe. Diſeaſes.

" In regard to the quality of paſture (adds Mr Findlater) as a cauſe of *ſickneſs*, Tweeddale farmers ſeem of opinion that it ariſes from the *foulneſs of the graſs* at the root in the hogs fences, which are never eaten bare. Some, therefore, take care to have the land to be ſaved for the hog fence, once eaten as bare as poſſible early in ſummer, by the black cattle upon the farm, or by old ſheep.

" It ſeems aſcertained in Tweeddale, that land which has been in uſe to be paſtured by older ſheep, when converted into a hog fence, is not liable for ſome time to produce ſickneſs. Two accidental experiments occurring in which this practice took place, in conſequence of new arrangements in the farms of Harehop in Eddleſtone pariſh, and of Lyne in Lyne pariſh, confirm this concluſion. It is farther confirmed by an experiment of Mr Murray, tenant in Flemington mill. About 20 years ago, he bought in different parcels of lambs for hogs, and laid them upon the hog fence of his hog farm of Broughton-haup, in Broughton pariſh. In one of the parcels of much higher condition than the reſt, the ſickneſs broke out to ſuch extent, that they were dying at the rate of two or three daily; ſo that the whole parcel ſeemed in imminent riſk. He transferred this whole parcel to the farm of Fingland in Newlands pariſh, where only old ſheep were kept, putting them on ſome of the lower paſture of that farm, which had been hained for feeding the crock ewes, and transferring a proportional quantity of theſe ewes to Broughton-haup hog fence. Not one of the lambs died upon Fingland. To the ſame effect, it deſerves attention, that in ſmall farms, not admitting of diſtinct hirſling, where, of courſe, old and young ſheep paſture mixed together, hogs are very little liable to ſickneſs, though perhaps worſe in other reſpects.

" From November at ſmearing time till Chriſtmas (1797) two facts with regard to the mode of cure have been ſtated to me, and which I am diſpoſed to think authentic. In the farm of Drummelzier, pariſh of Drummelzier, three hogs (out of four upon which the experiment was tried) recovered, upon bleeding, and having poured down their throats, a decoction of tobacco; about a finger's length of twiſt tobacco boiled in water till the water has diminiſhed to a gill, being the doſe for each. In the farm of Broughton-haup, pariſh of Broughton, within the ſame ſpace of time, nine or ten (out of 16 or 17 upon whom the experiment was made) recovered upon bleeding, and having an injection of tobacco ſmoke adminiſtered from a common tobacco pipe, by kindling the tobacco, inſerting the pipe ſhank into the anus and blowing: the experiment, however, was not ſo ſucceſsful

Diſeaſes.

ful in ſome later inſtances. I have long ago ſeen a ewe cured by bleeding, and injection of Glauber ſalts from a common clyſter-bag and pipe. When braxy breaks out, it might be uſeful, where attainable, to lay the hogs, nightly, upon dry ground, if the hog fence is wet, the chilline ſs of wet ground contributing no doubt to the production of inflammation. Clover foggage or turnips might be good preventives from, inducing a lax habit. *"

* *Findlater's Survey.*

11. DYSENTERY. *Molten-greaſe* or *Body-founder*, *Break-ſhaw*, (in ſheep). Gras fondu, Fr.

499 Dyſentery, or molten greaſe.

Dyſentery is the other diſeaſe that, with catarrh, forms Dr Cullen's order of profluvia; but as there are evident marks of inflammation of the bowels obſerved on inſpecting the bodies of ſuch animals as have died of this complaint, we have placed it immediately after inflammation of the bowels, in which we have followed M. Pinel and ſome other late writers.

This diſeaſe is not uncommon in the horſe, and probably it is ſtill more frequent in cattle and ſheep. It very commonly begins with ſome degree of fever, as a trembling, dryneſs of the mouth, loſs of appetite, a great degree of weakneſs, drooping of the head and ears, ſometimes a copious ſweating, but more commonly dryneſs and heat of the ſkin. There is uſually a heaving of the flanks, and the animal turns his head towards them, as if griped. There are frequent dejections from the anus, but theſe ſeldom conſiſt of the natural excrement, but of a mucous, ſlimy diſcharge, accompanied with a peculiar fatty ſubſtance like ſoft ſuet. There is evidently much diſtreſs during theſe evacuations, and ſometimes the fundament appears excoriated. It is not uncommon to ſee blood paſs with the ſtools, generally in ſtreaks, but ſometimes in ſuch a quantity as to tinge the whole diſcharge of a red colour; and in the latter ſtages of the diſeaſe there generally appear membranous, filmy ſubſtances, which have been compared to ſoaked leather. Theſe ſubſtances have been ſuppoſed to be the inner membrane of the bowels that has been eroded and thrown off by the violence of the purging; but they are merely coagulable lymph, ſuch as is very commonly thrown off from inflamed ſurfaces. The pulſe, towards the beginning of the diſeaſe, is commonly hard and full, but as the complaint goes on it becomes quick, ſmall, and ſometimes irregular. The animal is very ſtiff, and much averſe to motion, and if the diſeaſe continues long, there uſually comes on a ſwelling of the legs.

When animals that have died of this diſeaſe are diſſected, the inner coat of the bowels is found inflamed, in ſome places covered with coagulable lymph, ſuch as we have deſcribed as being thrown out in the diſcharge, and not unfrequently ulcerated in various parts, ſometimes mortified and corroded.

This diſeaſe does not appear ſo dangerous among the inferior animals in this climate, as in warmer countries; but it ſometimes proves fatal, or terminates in a weakneſs of the bowels and ſcouring, that are not eaſily removed. If the fever is but little or ſoon abates, if the animal appears not to labour under much pain, and if the diſcharge of natural excrement ſoon returns, the diſeaſe will probably terminate favourably in a ſhort time; but if there is great pain and fever, with exceſſive weakneſs, and if the mucous diſcharges continue very frequent, and mixed with much blood, the danger is conſiderable. Diſeaſes.

It is neceſſary to diſtinguiſh this complaint from the common purging or ſcouring, with which it is very generally confounded. It muſt therefore be obſerved, that in ſcouring, there is no fever, whereas this is common in dyſentery; that the diſcharge in ſcouring, though thin, has almoſt always the appearance of excrement, is not bloody, and is ſcarcely ever mixed with fatty matter.

Dyſentery is more common in hot weather, and in hot ſeaſons, than at other times; but is very commonly produced by the ſudden application of cold, eſpecially to the legs or belly, while the body is overheated and fatigued: hence ſwimming in autumn, drinking large quantities of cold water while in a profuſe ſweat, or other ſudden changes from heat to cold, have commonly produced it. It is ſaid to be frequently brought on by riding a horſe very hard in hot weather. Mr Lawrence ſays that when a boy, he rode a horſe that had a great deal of looſe groſs fleſh about him, 21 miles in a warm ſummer morning, and thus brought on an attack of *molten greaſe*. It is alſo not an uncommon diſeaſe among poſt horſes.

From the appearance of the fatty matter in the diſcharge that takes place in this complaint, the older writers on farriery were induced to give it the name of *molten greaſe*, conceiving that a principal part of the diſeaſe conſiſted in a melting down of the fat of the animal, which being conveyed by the abſorbents into the circulation, is thrown out by the exhalants on the bowels, and carried off with the dung. Mr Blaine laughs very heartily at this idea, and ſeems to pride himſelf on the diſcovery, that what has been miſtaken for fat, is nothing more than an increaſed ſecretion of the mucus of the inteſtines, and is as liable to a horſe with little fat, as to one with much. Mr Lawrence, on the other hand, argues ſtrenuouſly that this matter is really greaſy, and ſays, that "with reſpect to the evidence of ſenſe, had Mr Blaine ever ſeen a horſe under the diſcharge of molten greaſe, he might have found on experiment, that part of the diſcharges in queſtion is inflammable and liquefiable, which are not the characters of albumen, but of real greaſe; and, (continues Mr Lawrence) viewing the matter through the medium of experience, I can ſee no ſort of improbability in a colliquation of looſe, ſubſtantial, internal fat, by ſudden inflammation, and its conſequent effuſion and diſcharge by an unuſual emunctory. Gibſon gives an inſtance which convinced him (apparently incredulous before) of the poſſibility of a horſe's greaſe being melted. He found the fat melted and turned into an oil, and drawn off from its proper cells into the blood veſſels. He ſays farther, this diſeaſe is not unlike the greaſy diarrhœa which happens to men." Not having ourſelves ſeen a caſe of dyſentery in horſes, we are not prepared to decide the difference between theſe two champions of the old and new ſchool, but as Mr Lawrence is very worthy of credit in whatever has paſſed under his own obſervation, we have no doubt that this debated ſubſtance is of a fatty nature.

As it ſeems certain that dyſentery is of an inflammatory nature, it is proper to begin the cure by bleeding, eſpecially if the horſe is plethoric, or if the pulſe is full and hard. It will then be proper to clear the bowels

Diſeaſes. by a laxative clyſter, and to give internally a drench compoſed of five or ſix ounces of Glauber's ſalt diſſolved in a quart of water-gruel, or the drench N° 26 of the receipts; and this may be repeated every three or four hours. This will probably, in the courſe of the day, produce a plentiful diſcharge of excrement, and when the bowels appear well cleared, the horſe may have a warm maſh, be covered up warm, and perhaps a perſpiration will be brought on, which, if the diſeaſe is ſlight, will probably complete the cure. If the diſeaſe ſhould continue, an Engliſh pint, or pint and a half, of caſtor oil may be given, and clyſters, compoſed of water-gruel, or ſtarch boiled in water, ſhould be given warm very frequently. When by theſe means a pretty copious diſcharge of excrement has been produced, the horſe may have a ball compoſed of two drachms of opium, and half an ounce of ipecacuanha, or a drachm of emetic tartar, waſhed down with a quart of good porter. If there is conſiderable pain, it may be adviſable to foment the belly for half an hour at a time, with flannels wrung out of a warm decoction of poppy heads. During this treatment the horſe ſhould be kept clothed, and currents of air in the ſtable ſhould be avoided. When the diſeaſe is ſubdued, as the horſe will probably remain very weak, it will be proper to revive him by nouriſhing diet, and cordial and ſtrengthening remedies.

The appearances of dyſentery in cattle are not unlike thoſe that occur in the horſe, only that perhaps in them there is not ſo much of the *gras fondu*. The diſeaſe among theſe animals is commonly called *far-del-bound*. The treatment is the ſame as above deſcribed.

500 Breakſhaw in ſheep. This diſeaſe is not uncommon in ſheep, by the name of *breakſhaw*; but ſhepherds very commonly confound it with diarrhœa or purging. Mr Loch of Rachan, very properly diſtinguiſhes between them, and obſerves that the *breakſhaw* is analogous to dyſentery in the human ſpecies, and occurs moſt commonly in the end of wet ſummers. The diſcharge is thin and greeniſh (Mr Loch ſuppoſes from the wet graſs becoming acid in the ſtomach, and turning the gall green); it is more or leſs mixed with blood, ſometimes florid, ſometimes black and grumous; the animal pines for a week or two and dies, though ſometimes he recovers. The cure commonly employed by Mr Loch's herd, is warm milk poured down the animal's throat; but Mr Loch propoſes to try, in addition to this, nitre in half drachm doſes, with chalk or ſome other abſorbent powder, and 20 or 30 drops of laudanum twice or thrice a day, with frequent injections of warm milk and water. This plan ſeems beſt adapted to the latter ſtages of the diſeaſe. According to Mr Gilleſpie of Glenquich (quoted by Mr Findlater), this diſeaſe is often produced by overheating, when the ſheep are hunted by dogs, in folding them, &c. or when otherwiſe ſcared and terrified. It is ſtated by Mr Gilleſpie to be conſiderably infectious; and he conſiders tarring part of the flock to be the beſt means of checking the infection, under the idea that the ſmell of the tar will overcome that of the contagion,

501 Inflammation of the kidneys. 12. INFLAMMATION of the KIDNEYS. Nephritis. *Strain of the Kidneys.*

This diſeaſe is not uncommon among horſes and cattle; but it is more frequent in the former, as they are more expoſed to thoſe cauſes that appear generally to produce it. Diſeaſes.

The ſymptoms of this diſeaſe in horſes, are tolerably well marked. The horſe ſtands wide with his hind-legs, appears dull, and expreſſes conſiderable pain, often looking at his flanks. When preſſure is made on the loins the horſe flinches, and is evidently much diſtreſſed; the pulſe is hard and full, and commonly more frequent than natural. When both kidneys are inflamed, little or no urine is ſecreted, and what little is evacuated is generally bloody; but when only one kidney is inflamed, the other continues to ſecrete urine, but the natural quantity is on the whole much diminiſhed, and there is commonly conſiderable pain during the evacuation.

Inflammation of the kidneys is liable to be confounded with inflammation of the neck of the bladder, and the beſt means of diſtinguiſhing them, is to paſs the hand up the fundament, by which the ſtate of the bladder beneath may be eaſily aſcertained. If the bladder be conſiderably diſtended with urine, the inflammation is almoſt certainly ſeated in the neck of the bladder; but if the bladder be ſhrunk and empty, the diſeaſe is probably ſituated in the kidneys. It muſt be allowed, however, that this mark of diſcrimination will not hold good till the diſeaſe of the kidneys is pretty far advanced, as it very commonly happens that when a gland is inflamed, its ſecretion is at firſt increaſed. At the commencement of the diſeaſe, therefore, the ſymptoms which we have enumerated, eſpecially the ſenſibility which the horſe evinces on touching his loins, are chiefly to be depended on. It muſt be remarked, that one of the kidneys has been found diſeaſed, and even purulent, after death, when it ſhewed no marks of inflammation during life. This diſeaſe is attended with conſiderable danger, and unleſs the inflammation be ſpeedily removed, matter will be formed, which, if it does not paſs off by the urinary pipes into the bladder, will find a paſſage into the belly, or behind the peritoneum, and produce hectic fever and conſumption, or the kidney may mortify, and death will ſoon follow.

The kidneys may become inflamed, either from external injury, or from irritating ſubſtances that paſs through them in the courſe of the circulation. Inflammation of theſe organs is frequently produced by placing the ſaddle too far back upon the loins, and riding hard for a long time while it is in this poſition. It is ſometimes the effect of throwing cold water upon the body while it is in a ſweat; but according to Mr Blaine and Mr Feron, it is moſt frequently produced by the indiſcriminate uſe of ſtrong diuretic medicines.

In the treatment of this diſeaſe, we muſt vigorouſly employ the means that we have ſo often recommended for the cure of internal inflammations; bleeding in its full extent, emollient clyſters, and the production of external inflammation: but it is neceſſary in this diſeaſe to caution the practitioner againſt the uſe of bliſters, as the matter of cantharides, when taken into the circulation, and carried to the kidneys, will conſiderably increaſe the inflammation and diſtreſs. A good ſubſtitute for bliſters of cantharides would be, to pour hot water on the loins, ſo as to raiſe a bliſter on each ſide, which, however cruel it may appear, could not produce ſo much pain, as the animal already feels from the diſeaſe. It

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Diſeaſes. has been recommended, to excite a degree of inflammation in the external part of the loins, by means of firing; but probably the hot water will do as well, and is leſs painful. No medicine ſhould be given by the mouth, that is in the leaſt heating or irritating; and nitre, turpentine, balſam of copaiva, &c. ſo warmly recommended by moſt of the writers on farriery, would only ſerve to aggravate the diſeaſe. The horſe may drink frequently of water gruel, linſeed tea, or ſuch other mild, mucilaginous liquors; and if he ſeems to require food, bran maſhes will be the moſt proper article of diet. If there is much coſtiveneſs, purgative clyſters may be given, or in caſes of neceſſity, ſix or ſeven drachms of ſocotorine aloes in a ball. All exerciſe muſt be avoided, and the horſe ſhould have a good bed of litter, on which he may lie down when fatigued.

13. Inflammation of the Bladder. Cyſtitis.

502 Inflammation of the bladder.

The bladder may be inflamed either in its body, or in its neck, and the ſymptoms differ ſomewhat in theſe two varieties. When the body of the bladder is inflamed, there is produced ſuch a degree of irritation, that the bladder becomes incapable of retaining its contents for any length of time; and the animal is perpetually making ſmall quantities of urine. He alſo makes frequent attempts to dung. On paſſing the hand up the fundament, the bladder will be found very hot and ſenſible; and in this variety of the complaint, as in inflammation of the kidneys, it is empty and collapſed.

When the neck of the bladder is inflamed, there is at firſt a ſuppreſſion of the urine, but afterwards it is continually paſſing off in drops; and on examining the bladder by the fundament, it will be found more or leſs diſtended, according to the continuance of the complaint. There is uſually conſiderable fever in both caſes. The pulſe is hard and full at the beginning of the diſeaſe, but after this has continued for ſome time, the pulſe becomes ſmall and oppreſſed.

Inflammation of the bladder takes place more frequently in male than in female animals; but it is ſaid to be ſometimes produced in the latter, at leaſt in mares, by paſſing ſome irritating ſubſtance up the urethra, in order to make them horſy. Both caſes of this diſeaſe are attended with conſiderable danger; but the latter is generally the moſt dangerous; but in a mare a cure is generally eaſier than in a horſe.

The treatment of this complaint differs little from that of the inflammation of the kidneys, and chiefly conſiſts in bleeding, the frequent uſe of ſoftening clyſters, low diet, and the production of external inflammation by any other means than the uſe of cantharides bliſters. If the bladder be found conſiderably diſtended, it will be neceſſary to evacuate the urine, either by the means of a catheter, which may be eaſily paſſed up in a mare, or by making an opening into the bladder; for performing which in the male, Mr Feron gives the following directions. "It happens that the urethra is ſo conſtructed, that it is not in our power to introduce an inſtrument immediately into the bladder, without performing an operation; for the urethra of the horſe forms two curvatures or angles, before it reaches the bladder, and therefore it is not poſſible to introduce an inſtrument into the bladder, which will preſerve its curvity all the way. We therefore introduce a ſtaff of a pliable wood, or whalebone, to the angle at the os pubis, as near the rectum as poſſible with ſafety; we make a cut upon it, and then introduce the female catheter, or ſome ſimilar tube, without however removing the ſtaff to prevent our loſing the inciſion, taking care to avoid the inſtrument's paſſing into the cellular membrane, inſtead of entering the bladder. If ſuch an accident was likely to happen, it is adviſable not to attempt the operation, but to continue and inſiſt upon all the emollient remedies. Diſeaſes.

"We may alſo puncture the bladder with a trocar, by the rectum, or through the inferior part of the abdomen.

"In either caſe we are likewiſe directed by Mr Coleman, to make the puncture as near the os pubis as poſſible, that we may not wound the peritonium anteriorly. By this method the operation recommended through the rectum may be performed without expoſing, or opening the cavity of the abdomen" *.

In the female an opening may be eaſily made into the bladder, with a trocar, introduced by the vagina. It has been recommended in the mare, to throw up an injection of ſome oily or mucilaginous fluid, to ſupply the place of mucus, in ſheathing the bladder from the irritation of urine. As in the inflammation of the kidneys, every thing that can heat or irritate the urinary organs muſt be carefully avoided.

* *Feron's Farriery*, p. 189.

14. Cords.

503 Cords.

It is well known in moſt breeding countries, that a great many calves die every year, of an unknown diſeaſe, with which they are affected very ſhortly after birth. The common name which this diſeaſe receives in Scotland, is *the cords*; and while its fatal and widely extended effects are the ſubject of juſt regret, the diſeaſe itſelf is looked on as incurable, and no pains are taken to inveſtigate its nature, ſymptoms and cauſes, and no remedies ſuggeſted, as a cure or preventive. Whatever be its nature, this diſeaſe is exceedingly dangerous, and ſo extremely rapid, (terminating frequently in a night's time), that all means of relief are commonly uſeleſs even before it is obſerved.

Almoſt all calves, that are ſaid to have died of *the cords*, appear, when they are opened up, exceedingly red, and the ſmall leaders, or ligaments, are conſiderably ſwelled, and have ſome reſemblance to ſtrings paſſing through the internal parts, from which probably the diſeaſe has its name. Every ſymptom indicates a conſiderable degree of plethora, if not a very high degree of inflammation.

It is commonly obſerved, that calves are moſt liable to be affected during the firſt days, or weeks, after they are calved. If they outlive five or ſix weeks, they are ſeldom in any danger.

Calves that ſuck their mothers, we believe, it will be found, are not ſo liable to the diſeaſe, as thoſe who are fed by the hand.

The greateſt number of calves who fall a ſacrifice to this diſeaſe, if not the whole of them, are thoſe who are cloſely confined to the houſe from their birth, without ever being expoſed to the free open air without doors. It is a well known fact, that calves who are dropt without, and remain in the fields, are in little or no danger. Cows that are laid on to graze for beef frequently turn out to be in calf; and it is no uncommon thing to ſee them drop their calves in the midſt of froſt and ſnow, and yet

theſe

Diſeaſes. theſe young creatures, if they can once get to their feet, without being frozen to the ground, are hearty and well. Calves, lambs, and foals, require exerciſe and freſh air; and nature directs them to take a great deal. It is aſtoniſhing to ſee with what force and vigour, (paticularly the calf), and how long, they will run. But this free, unconſtrained, and ſevere exerciſe without doors, ſeems to be the very thing that makes them thrive, and to be neceſſary to their very exiſtence. *

* *Farm. Mag.* vol. iv. 59.

The great object is to prevent this diſeaſe; and the following method of treating the new-born calves, practiſed by a correſpondent of the Farmers Magazine, ſeems to be attended with complete ſucceſs.

The time when this gentleman's cows are bulled is regularly noted down in a book; and when they are near calving, they are watched frequently night and day. As ſoon as the calf is dropped, it is received into a large baſket or ſkull, made of willows, with a handle at each end, and plenty of clean ſtraw in it. It is then carried by two perſons to the ſtall in the calf-houſe, where it is gently rubbed with ſtraw. The calf-houſe is next to the cow-byre; and is fitted up with ſtalls like a ſtable, about three feet wide, and about five feet long. Every ſtall ſhuts in by itſelf, with a door and hinges, for fear of the calf lying back too far, to choke itſelf in its binding. As ſoon as the mother has had a little reſt after calving, ſhe is milked, and a little of the milk given to the calf as early as poſſible. If the weather is cold, and the mother long in giving milk, it is taken to the fire, and warmed in a pan until it is blood-warm, and then given to the calf; about ſix or eight gills, according to the ſize of the calf, and repeated four times in 24 hours. As the calf gathers ſtrength, the quantity may be increaſed; but too much milk at one time is as bad as too little, until it is a month or ſix weeks old. When the calf is able to ſtand, it is tied to a ſtake; as it is more in the power of the ſervant to give it milk in that ſituation, than when going about looſe. If a calf gets cold milk, it is ſure to bring on a trembling; and the *cords* or ſome other malady follows; which he has often ſeen exemplified amongſt the neighbouring young ſtock †.

† *Ib.* p. 296.

504 Farcy.

15. Farcy. Le Farcin, Fr.

We ſhall conclude this chapter with a brief account of two diſeaſes; or rather, as it ſhould ſeem, of two modifications of the ſame diſeaſe, that frequently take place in the horſe, to whom they are almoſt peculiar; though ſomething like them is occaſionally found in other animals. We ſhall hereafter take notice of what farriers call the water farcy, which we conſider as ſimilar to *anaſarca* in the human body; but the diſeaſe we are about to deſcribe, appears to be rather a peculiar inflammatory affection of the abſorbent veſſels below the ſkin. There ſeems to be two varieties of farcy, acute and chronic; or rather a mild and a malignant variety.

The commencement of farcy appears to be rather obſcure, and probably it is ſeldom obſerved in the beginning of the inflammation. The firſt appearances that are deſcribed by writers, are a number of ſwellings, that riſe in almoſt every part of the body, particularly the head, neck, and extremities. The lymphatic veſſels below the ſkin appear like knotted cords; and this appearance is found to be owing to a diſtenſion and inflammation that take place in theſe veſſels, eſpecially at their valves, where the knots are produced. As the diſeaſe proceeds, theſe knotted ſwellings burſt, and ulcers are formed, which are very difficult to heal. The formation of theſe ulcers may be conſidered as terminating the mild ſtage, and commencing the malignant form of the diſeaſe; in which the horſe loſes his appetite, grows lean and weak, and commonly has a degree of hectic fever. If the progreſs of the diſeaſe has not been arreſted, a ſwelling takes place in the head and noſe, and there comes on from the latter a copious diſcharge of a peculiar glairy mucus, which ſhews that the diſeaſe has degenerated into *glanders*, under which name we ſhall proceed to deſcribe it; and ſhall afterwards conſider the nature, cauſes, and treatment of both. Diſeaſes.

16. Glanders. Le Morve, Fr.

505 Glanders.

According to Mr Blaine, the uſual ſymptoms of *glanders* are an increaſed ſecretion of the mucus of the noſe, which is at firſt thick, and like the white of an egg. He has ſeen it continue ſo, while at other times it becomes purulent; but there is uſually a degree of viſcidity and glueineſs about the matter, that as it were fixes the ſides of the noſtrils together, and is ſtrongly characteriſtic of this diſeaſe. On examining the noſtrils, there may generally be perceived a number of ulcerated ſurfaces, very ſimilar to ſhankers that occur in the venereal diſeaſe. Theſe ulcers do not always appear ſoon; but they are produced in all virulent caſes, and never fail to appear when the diſeaſe terminates fatally. They are at firſt ſmall, and diſpoſed in lines along the lymphatic veſſels; but as the ulceration proceeds, it becomes more extenſive, till the whole inner ſurface of the noſtrils is affected, and at length the bones of the noſe are affected, and become carious. When the ulcers have continued for ſome time, the matter changes its glairy appearance, and becomes bloody and offenſive; and this is more particularly the caſe when the bones become diſeaſed. In the latter ſtages of the complaint, the emaciation and weakneſs of the animal are greatly increaſed; he becomes affected with a ſhort tickling cough; the hair grows dry and harſh, and falls off on the ſlighteſt touch, and thus the horſe gradually pines away.

Sometimes only one ſide of the head is affected, but more commonly both at the ſame time.

The beſt account of the appearances of glanders on diſſection, has been given by M. Chabert, in a work which he publiſhed in 1785, on the means of aſcertaining the exiſtence of glanders, and of preventing their effects. From the numerous bodies which he opened, M. Chabert has drawn up the following general account of the morbid appearances.

The lungs are generally more affected than any other of the viſcera; we find them often ſwelled and filled with hydatids, tubercles, and obſtructions. The bronchial glands are very often ſwelled and ulcerated, and this is ſometimes the only injury that we can perceive on diſſections. The membrane that lines the bronchia and the wind-pipe, is moſt commonly inflamed and ulcerated; the bronchia are filled with a thick matter, that commonly reſembles what the animal diſcharges by the noſtrils. The internal ſurface of the bones that form the different cavities of the noſe, and the griſly partition of the noſtrils, are often carious, and covered with purulent matter; and the membrane which lines the noſtrils

Diſeaſes. noſtrils is ulcerated. The ſpleen, the liver, and the kidneys, are alſo ſometimes conſiderably diſeaſed; and the ulcerated ſtate of the kidneys, not unfrequently appears during life, by the purulent matter that is diſcharged with the urine. On opening the head, we ſometimes find the brain ſofter and more flaccid than in a healthy animal. There is often a great quantity of ſerum in its cavities, and the glands are much ſwelled.

The glanders is liable to be confounded with ſeveral of thoſe diſeaſes, in which an unuſual diſcharge proceeds from the noſtrils; as catarrh, ſtrangles, and conſumptions; but chiefly with the two former. It may be diſtinguiſhed from catarrh, by the abſence of fever in the early ſtage; by the matter diſcharged from the noſtrils being thick and glairy from the firſt; whereas, in catarrh, there is almoſt always conſiderable fever in the beginning, and the diſcharge is at firſt watery. In a common cold the general health is alſo more or leſs affected, and from the firſt there is uſually a cough and loſs of appetite; whereas, theſe ſymptoms ſcarcely ever come on in glanders, till the diſeaſe has ſubſiſted for a conſiderable time. Glanders may be diſtinguiſhed from ſtrangles by the high fever which commences the latter, and by the ſwelling and ſpeedy ſuppuration of the glands of the mouth and throat.

506 Of theſe two affections, glanders is the moſt dangerous; as farcy, when taken at its commencement, may frequently be removed; but we believe the inſtances of a perfect cure in glanders are very rare.

The cauſes of theſe complaints are very obſcure. It is ſaid that farcy may be brought on by the ſame cauſes that prediſpoſe to mange, as want of cleanlineſs, hard work, and low diet; and there is no doubt, that this diſeaſe, as well as glanders, is contagious. Glanders, beſides being produced by contagion, may alſo be the termination of ſeveral diſorders, as of catarrh, ſtrangles, and conſumption, however different from theſe diſeaſes in their commencement.

The nature of glanders is not well underſtood, although, of late, many ingenious men have inveſtigated the ſubject, and made conſiderable diſcoveries. It is not certain when the diſeaſe was firſt known. Mr Lawrence dates it from the ſame period with the *Lues Venerea*; but there ſeems no doubt that the diſeaſe was known to the ancients, though we do not know by what name it was called. Vegetius ſpeaks of a diſeaſe which he calls *humiditas*, which Mr Blaine ſuppoſes to be the ſame with our glanders; but which the learned Camper conſiders as analogous to the murrain, See N° 466. Blundevil, and after him Markham, give the following deſcription of its riſe, progreſs, and completion. "Of cold firſt cometh the poſe, (that is ſtoppage of the head), and the cough, and then the glanders, and laſt of all the mourning of the chine." The two Meſſieurs Lafoſſe, made, as we have ſeen, ſeveral diſcoveries with reſpect to glanders, eſpecially the father, who, in 1749, demonſtrated before the academy of ſciences at Paris, that the ſeat of the diſeaſe is wholly in the pituitary membrane; and he propoſed curing it by injecting the whole of this membrane through openings made with the trepan, into the frontal, naſal, and maxillary ſinuſes. Lafoſſe divided the diſeaſe into ſeveral ſpecies; but it appears that all theſe may be reduced to two, the mild and malignant, or the chronic and acute; the chronic being that in which the running of the noſe is trifling, and of a tranſparent colour, with no appearances of ulceration in the noſtrils; while in the acute or malignant variety, there is conſiderable ulceration; the diſcharge is very offenſive; there is a ſwelling below the under jaw, and the bones of the noſe are carious. Diſeaſes.

The beſt of the Engliſh writers on farriery appear to have known little or nothing of the diſeaſe more than the ſymptoms. Dr Bracken conſidered it as not contagious, and Gibſon gives but a poor account of it, for which he ſeems indebted to Snape.

"The late profeſſor of the veterinary college (ſays Mr Blaine), publiſhed his remarks on this diſeaſe, but it is evident that he knew little or nothing relating to it, but what he gained from Lafoſſe, and conſequently his opinions offered nothing new. The preſent profeſſor has proſecuted the inquiries relative to it much farther, and by an extenſive courſe of experiments has thrown very conſiderable light on the nature of the diſeaſe; and though we are not yet much more ſucceſsful in attempts at the cure, yet we have leſs reaſon to deſpair. By Mr Coleman's experiments it is proved beyond a doubt that farcy and glanders are ſpecifically the ſame diſeaſe, but affecting different parts: to eſtabliſh this, horſes have been inoculated with the matter of farcy, and glanders has been produced; which put the matter beyond a doubt. Farther, Mr Coleman produced glanders in a ſound animal by the inoculation with the matter of glanders. This M. St Bell aſſerted could not be done. Farcy has likewiſe been produced by the ſame means, but it appears that it was ſome time before it could be effected; but it has been produced by Mr White. It cannot therefore be inferred, that becauſe the farcy and glanders are ſo different in their apparent ſituations they are diſtinct diſeaſes: every poiſon has its preference of parts; and likewiſe the ſame poiſon, under different modifications affects different parts.

Mr Coleman is of opinion, that in glanders, the whole circulating fluids are affected. To prove this, he bled an aſs from the jugular vein till he was to all appearance dead, when he introduced the blood from the carotid artery of a horſe labouring under glanders, till the aſs was reanimated. In a few days the moſt malignant glanders appeared. I believe another aſs was inoculated from this, which became glandered. This experiment, I think, (adds Mr Blaine), throws great light on this complaint, and indeed on pathology in general; and we may hence be led to hope, that internal remedies may be more uſeful than external, which have been thought to be the only means by which we could hope for a cure; for provided we could deſtroy the poiſon exiſting in the blood, and keeping up the action in the part; the action, or at leaſt the ſpecific part of it, might ceaſe in the affected part, and we might induce a healing proceſs by the uſual means. As ſuch, our only hope muſt conſiſt in exciting a new action in the ſyſtem, whereby the glanderous one will be ſuſpended, till by the continuance of the new action the virus of glanders is completely expelled by the change the fluids naturally undergo*."

The treatment of theſe diſeaſes will differ according to their ſtate and degree of malignity. For the cure

* *Blaine's Outlines*, vol. ii. p. 525.

Diſeaſes. of farcy, bliſters are much extolled by Mr Feron, and the actual cautery, is very generally employed to deſtroy the ſwellings of the lymphatics, and to excite theſe veſſels into greater action. To aſſiſt this purpoſe, diuretics are to be adminiſtered, and the horſe ſhould take as much exerciſe, eſpecially draught labour, as he will bear without conſiderable fatigue. Two remedies have of late been employed internally, when the ſyſtem becomes conſiderably affected; theſe are verdigriſe, and corroſive ſublimate. Mr Feron directs the former to be given in the following manner. A ball compoſed of one drachm of verdigriſe, and a quarter of an ounce of common turpentine, is to be given every night and morning, gradually increaſing the quantity of verdigriſe till the horſe can take from three drachms to half an ounce in the courſe of the day. If the animal becomes coſtive, he is to have a clyſter night and morning, and a purgative ball of ſeven drachms of aloes, and half a drachm of calomel once a week. After having gone through a regular courſe of phyſic, he is to have the following balls. An ounce of green copperas (E) in powder is to be mixed up with Venice turpentine, and a ſufficient quantity of linſeed powder, to make eight balls, one of which is to be given every morning, while coſtiveneſs is to be avoided as before directed.

In giving the corroſive ſublimate, we ſhould begin with a ſmall doſe (ſee STIMULANTS), and gradually increaſe it ſo long as the ſtomach will eaſily bear it. As mercury in ſome form ſeems to be the beſt remedy that can be employed in theſe affections, calomel, or the common blue pill, may be given inſtead of the corroſive ſublimate, if the latter ſhould occaſion much diſorder, or if the horſe is very much weakened. During this courſe the animal muſt be ſupported by nouriſhing diet, but ſhould frequently have a change of ſucculent vegetable food. Mr Blaine ſpeaks of a horſe that was ſo far reduced (by glanders, we ſuppoſe) as not to be able to ſtand, and who was drawn into a field of tares, and ſuffered to take his chance; the conſequence was that when he had eaten all within his reach, he was able to riſe and ſearch for more, and eventually recovered.

The treatment recommended above has, it ſeems, often been ſucceſsful in farcy, and the ſame internal remedies have been recommended in glanders, but we believe they have been employed with little ſucceſs. Mr Feron adviſes to draw blood in the beginning of glanders, while the diſeaſe is ſtill local, and to keep the animal upon warm maſhes of bran, putting the ſame into a noſe-bag, for the purpoſe of fomenting the noſtrils. He is then to go through a courſe of gentle phyſic, while ſtrict attention is paid to the neceſſary direction of the food, exerciſe, dreſſing, cleanlineſs, and water. The water muſt be always warm, and made white with bran or gruel. After this courſe, he recommends balls made of opium, arſenic, and ſulphur, or of extract of hemlock, calomel, &c. avoiding coſtiveneſs during their exhibition. He thinks it neceſſary to inſert two rowels, one below the under jaw near the ſwelling, and another under the cheſt; and he recommends frequently ſyringing the noſtrils with a lotion made of two ounces of ſpirit of wine, and the ſame quantity of vinegar, mixed with a gallon of water; or with a ſolution of corroſive ſublimate. According to this gentleman, if the diſorder is attacked in its infancy, it will generally ſubmit to the above courſe of treatment; but if the diſorder is ſo far advanced as to exhibit the ſymptoms of virulence, which we have deſcribed as conſtituting the acute or malignant ſtage of it, it will increaſe in oppoſition to all art, and it will be neceſſary to take away a life that every degree of aſſiduity would not render worth preſervation. Diſeaſes.

As the farcy is probably contagious, and the glanders in moſt caſes is certainly ſo, it is proper, as ſoon as a horſe is affected with either of theſe diſeaſes, to keep him in a ſeparate ſtable, and to take care that he does not come near any other horſes; and no part of his harneſs, or furniture ſhould be uſed for any other horſe, till it has been well waſhed with ſoap and water, and expoſed for a long time to the pure air.

Glanders is conſidered by Dr Darwin, and ſome other writers, as a contagious catarrh, and in ſome caſes it certainly is ſo; but when it is the conſequence of farcy, or of dangerous chronic diſeaſes, it appears to be an affection of a peculiar kind. Mr Lawrence conſiders the glanders as ſo perfectly incurable, that he recommends the *collarmakers knife* as the eaſieſt, cheapeſt, and moſt infallible remedy.

CHAP. III. *Of Lethargic or Comatoſe Diſeaſes.*

1. APOPLEXY. Vertige, Fr. *Staggers, Sleepy Staggers, Lethargy*, or *Vertigo*.

507 Apoplexy, or Staggers.

Staggers is one of the moſt comprehenſive terms in farriery; and under it are confounded almoſt every affection of the brain, or all thoſe diſeaſes in which there take place giddineſs, unuſual heavineſs, drowſineſs, or convulſions. We have already ſeen the term applied to inflammation of the brain, and we have no doubt that many caſes are deſcribed as *ſtaggers*, which are really inſtances of *epilepſy*. Of this kind we conſider the caſe ſo humorouſly related by Mr Lawrence in his treatiſe on horſes, vol. ii. p. 406. "Walking up Fleet-ſtreet, I obſerved a crowd of people wonderfully diverted with the agonies of a cart-horſe beating himſelf almoſt to pieces, in, I think, the moſt violent convulſions I ever witneſſed. He threw himſelf repeatedly upon the foot-path, and was very near going headlong into a ſhop, &c."

Mr Feron, who in general keeps very clear of the errors of ordinary farriers, which he often ridicules with much ſucceſs, has confounded *inflammation of the brain* and *apoplexy*, under the general name of *ſtaggers*, conſidering them as both inflammatory, and merely modifications of the ſame diſeaſe. Even Mr Blaine, who, as Mr Lawrence expreſſes himſelf, ſeems upon every occaſion eager to catch the *dernier goût* of ſcience, has

(E) Mr Feron directs green *copper*: but we ſuppoſe this is merely a typographical error, for copperas, or ſulphate of iron; and we have therefore ordered it by this name, as ſulphate of iron is a good tonic, and may be very properly employed in this diſeaſe.

Diſeaſes. deſcribed ſtaggers under the name of *lethargy*, and does not even mention its identity with apoplexy in the human body.

We conſider *ſtaggers* properly ſo called, as the ſame with *apoplexy*; the appearances, the cauſes, and the treatment of both are the ſame, making allowance for ſome ſlight variations in the ſtructure and economy of the different animals whom they affect.

This complaint ſometimes comes on ſuddenly; but in general it is preceded by ſymptoms that mark a conſiderable determination of blood to the head, ſuch as heavineſs, drowſineſs, inſenſibility, (ſee N° 317) occaſional fits of giddineſs, (ſee N° 318.) and partial blindneſs, (ſee N° 321.). There ſeems no doubt that the horſe is ſometimes affected with headache, which appears by the animal's hanging down his head and drooping his ears, by the eyes being dull and watery, by dropping of urine, and coſtiveneſs. Theſe ſymptoms often precede an attack of apoplexy, though they are ſometimes only ſigns of a diſordered ſtomach.

When a fit of ſtaggers comes on, the animal falls ſuddenly, and is perhaps convulſed for a few minutes, but more commonly appears quite inſenſible. The pulſe during the fit is uſually ſlower than natural, and much oppreſſed; the breathing is ſlow, heavy, and laborious, and there is evidently an increaſed accumulation of blood in the veſſels of the head. The animal remains for a longer or ſhorter time in the fit, and ſometimes he never recovers; but, in general, in eight or ten minutes, the fit goes off, and the animal riſes. Sometimes after a fit of the ſtaggers, the animal appears for a time more active and lively than before; but very often he remains heavy and ſleepy, eſpecially after repeated attacks, and ſometimes a paralytic affection of ſome of the limbs is the conſequence of the fit.

Apoplexy may be diſtinguiſhed from inflammation of the brain, by the fever, reſtleſneſs, and fiery appearance of the eyes, that never fail to uſher in the latter complaint. We would diſtinguiſh it from *epilepſy*, by the foaming at the mouth, and ſtrong convulſions, by which this latter is always accompanied.

An apoplectic fit may be the conſequence of an overloaded or otherwiſe diſordered ſtomach; and is no uncommon termination of ſeveral diſeaſes, as *epilepſy*, *locked jaw*, &c. But it is generally the conſequence of too much fullneſs of blood, brought on by a full diet, attended by idleneſs or want of exerciſe. It is more common to old than to young animals, eſpecially ſuch as have large heads and ſhort necks. For the immediate and many of the exciting cauſes of this complaint, ſee APOPLEXY, MEDICINE *Index*.

A fit of apoplexy is often produced in an animal that is prediſpoſed to it, by ſome ſudden or violent exertion, ſuch as drawing a heavy load, &c.

The means of preventing apoplexy when an attack of it is threatened, have been already explained (in N°. 317, 318, and 427.) When a fit of *apoplexy* takes place, if the animal is full of blood, which generally happens, it will be proper to bleed, from the temporal artery, or jugular vein, to an extent proportioned to the ſtate of the animal. If the animal appears weak, bleeding ſhould not be attempted; but the determination of blood to the head may be effectually checked by making preſſure upon the *carotid artery*, taking care at the ſame time, not to include the jugular veins. Mr Coleman recommends tying up the carotid arteries in dangerous caſes of ſtaggers, and Mr Feron ſays, that he has often repeated this experiment with ſucceſs. The bowels ſhould be emptied in the uſual manner, as ſoon as poſſible; and a ſtrong ſtimulating clyſter ſhould be injected. When the animal comes to himſelf, if fat and plethoric, he ſhould have a good ſtrong purgative ball, and afterwards ſome gentle diuretic medicines. He ſhould be kept quiet for ſome hours after the fit; but when the phyſic has properly wrought, he ſhould have gentle exerciſe, which muſt be gradually increaſed, according as he is able to bear it; and great care ſhould be taken to keep the bowels open, and to prevent too great an accumulation of blood. Diſeaſes.

2. PALSY. Paralyſis. *Thortor-ill*, (in ſheep.)

The inferior animals ſometimes become *paralytic*, and we have ſeen that a palſy in the hind legs is one of the principal ſymptoms of the *diſtemper* in dogs. A paralytic diſorder is not uncommon among ſheep, and is called by ſhepherds the *thortor-ill*. It ſometimes ariſes from their having eaten ſome poiſonous or narcotic plants, but is very generally the effect of great weakneſs produced by want of proper nouriſhment. The beſt remedy ſeems to be white vitriol, given three times a day; and the food ſhould be of the moſt wholeſome and nouriſhing kind. 508 Palſy.

We had intended in this chapter to conſider pretty much at large, the various caſes of ſuſpended animation, or *aſphyxia*, ſuch as *drowning*, *hanging*, *ſuffocation* from fixed air or other noxious gaſes, and *torpor* from cold; but this article has already ſwelled to an unexpected length, and we have yet much important matter on our hands. We muſt therefore refer our veterinary readers to the article MEDICINE; as the means to be there directed for reſtoring ſuſpended animation in man will, with ſome little modification, apply to ſimilar caſes in the domeſtic animals.

CHAP. IV. *Of Spaſmodic Diſeaſes.*

1. LOCKED-JAW. Tetanus. *Stag-evil.* Mal de Cerf.

It has been remarked in N° 10. that horſes are extremely ſubject to the locked-jaw, which proves one of the moſt obſtinate and fatal diſeaſes by which they are affected. It ſeems alſo occaſionally to appear among cattle, but it occurs to them much leſs frequently than to horſes. We do not know that any writer has deſcribed this diſeaſe in the horſe better than Mr Gibſon, whoſe deſcription we ſhall therefore copy, though it is expreſſed in rather an uncouth ſtyle. 509 Locked jaw.

"As ſoon as a horſe is ſeized in this manner, his head is raiſed with his noſe towards his rack, his ears pricked up, and his tail cocked, looking with an eagerneſs, as an hungry horſe when hay is put down to him, or like an high-ſpirited one, when upon his mettle; in ſo much that thoſe who are ſtrangers to ſuch things, when they ſee a horſe ſtand in this manner, will ſcarce believe any thing of conſequence ails him; and I have ſeen ſuch perſons greatly ſurpriſed when they have been told of the danger. But they are ſoon convinced, when they ſee other ſymptoms come on apace; that his neck

grows

Diſeaſes. grows ſtiff, cramped, and almoſt immoveable; and if a horſe in this condition lives a few days, ſeveral knots and ganglions will riſe on the tendinous parts thereof; and all the muſcles both before and behind, will be ſo pulled and cramped and ſtretched, that he looks as if he was nailed to the pavement, with his legs ſtiff, wide, and ſtraddling; his ſkin ſo tight on all parts of his body, that it is almoſt impoſſible to move it; and if trial be made to make him walk, he is ready to fall at every ſtep, unleſs he be carefully ſupported; his eyes are ſo fixed with the inaction of the muſcles, as gives him a deadneſs in his looks. He ſnorts and ſneezes often, pants continually with ſhortneſs of breath; and this ſymptom increaſes till he drops down dead, which generally happens in a few days, unleſs ſome very ſudden and effectual turn can be given to the diſtemper."

This diſeaſe is generally primary or idiopathic; but it is ſometimes ſymptomatic. The pulſe is not always much affected; there is ſeldom any fever, and the internal functions are ſeldom impaired till towards the latter ſtages of the diſeaſe.

We have not many accounts of the appearances that have been diſcovered on diſſecting horſes which have died of this diſeaſe. In two diſſections by M. Huzard, the bowels within the belly, eſpecially the ſtomach and large inteſtines, were conſiderably inflamed; the liver was full of black and fluid blood, and in one caſe a conſiderable quantity of blood had eſcaped into the cavity of the belly; the ſubſtance of the liver was very tender, as if it were decompoſed or rotten. The other viſcera of the belly, and the heart and lungs, were in their natural ſtate. On opening the head, conſiderable marks of inflammation appeared in the brain, the *choroid plexus* was diſtended with blood, and in one caſe the maxillary and frontal ſinuſes of the right ſide were full of black blood; the *dura mater* was inflamed, and its veſſels, as well as thoſe of the brain, were turgid with blood; the ventricles of the brain contained a quantity of ſerous fluid. In one of the caſes the inflammation had extended even to the periofteum on the right ſide, which was much redder than that on the left.

It is difficult to ſay whether the diſeaſe depended on an inflammatory affection of the brain, or whether this was the conſequence of the violent ſpaſmodic contraction of the muſcles during the height of the diſeaſe: but we are inclined to think the latter was the caſe.

Inſtances of recovery from this diſeaſe in horſes are very rare; we ſhall preſently give one from Mr Gibſon, which is rather remarkable. A cautious opinion ought therefore to be given in every caſe of locked-jaw.

This affection may be produced by various cauſes, particularly from wounds, where the nerve is partially divided; from cold, when the body is in a profuſe ſweat. It may ariſe alſo from internal irritation, as from worms, which, in Mr Gibſon's opinion, are a very common cauſe of it. Probably it more frequently proceeds from wounds, as a puncture in the foot or any other part; and it has certainly often been brought on by the barbarous operations of *docking* and *nicking*. There ſeems no doubt that the brain is the principal ſeat of the affection.

In the treatment of locked-jaw, it is neceſſary to uſe ſome vigorous meaſures as early as poſſible; but unhappily no method hitherto adopted has proved ſucceſsful, even in a few caſes. Opium, aconite, hellebore, &c. Diſeaſes. have been tried in the veterinary college in very large doſes, but without any beneficial effects. From conſidering it as a diſeaſe of the brain, trepanning has been uſed, with the view of making preſſure on the brain, and this has ſometimes appeared to take off the ſpaſm of the muſcles; but as ſoon as the preſſure was removed, the ſpaſms returned with nearly equal violence. An infuſion of tobacco, to the amount of two pounds, has been given by Mr Coleman, but the ſymptoms appeared to be aggravated. Mr Feron recommends bleeding, and immerſing the animal in a warm bath at 90° of Fahrenheit, ſo as to keep the whole body covered with the water for two or three hours, which he has known to be ſucceſsful; but the horſe muſt afterwards be clothed and kept very warm. The moſt probable means to relieve the animal ſeem to be giving opium in large doſes by way of clyſter, frequently repeated, and rubbing the whole body frequently with ſome ſtimulating linement, ſuch as oil of turpentine and tincture of cantharides. Mr Blaine recommends a clyſter compoſed of a ſtrong decoction of poppy heads, with two ounces of camphor diſſolved in brandy; or if this be thought too expenſive, one with two ounces of ſpirit of hartſhorn and four ounces of oil of turpentine, mixed with two or three yolks of eggs, and a pint of ale. The cold bath is found one of the moſt effectual remedies in the human body, and we ſhould conceive that it is more likely than any other means to do good in the horſe; but it will be neceſſary to rub him as dry as poſſible after throwing the water over him.

If it is aſcertained that the diſeaſe proceeds from a punctured or lacerated wound, it will be proper immediately to ſcarify the wounded part, ſo as, if poſſible, completely to divide the affected nerve, as in ſome caſes where this has been done, the ſpaſms have been removed. It muſt be confeſſed, however, that even this has frequently failed. If it has proceeded from a punctured wound in the foot, Mr Blaine thinks it adviſable to take up the nerves of that foot on each ſide; for though this might occaſion temporary lameneſs, yet, if the horſe were ſaved, this might be removed in a few weeks.

The following caſe related by Mr Gibſon, in his Caſe. 510
laſt work on the diſeaſes of horſes, is very inſtructive; even though it ſhould be contended that the cure was effected by nature, and not by Mr Gibſon's remedies.

A young troop horſe was ſuddenly ſeized with this kind of convulſion, which was firſt diſcovered as he was leading out to water, at the afternoon's watering time. "I happened, (ſays Mr Gibſon), to be then preſent, and perceived him come reeling along with his noſe turned out, his eyes fixed and immoveable, with all the other ſigns that uſually attend this fatal diſtemper; and when he came to the trough he could not reach the water becauſe of the cramp and ſtiffneſs of his neck; and when it was held to him in a pail, could not drink, though he ſhewed an eagerneſs for it; his mouth being ſhut up ſo cloſe, that it was ſcarce poſſible to put a knife between his teeth. When we found it impoſſible to adminiſter any kind of medicine, till by rubbing his cheeks, jaws, and temples, and his whole neck, for a conſiderable time, we made a ſhift, with great difficulty, to thruſt down part of a calomel ball, on the end of a ſmall ſtick, and then to put into his noſtrils, a very ſmall portion of a ſtrong cephalic drink, thinking by that means

to

Diſeaſes.

to convey the ball downwards into his ſtomach, which however had but little effect, any farther than this, that he had not ſuch ſudden fits and agitations as I have ſeen in others in the like circumſtances, but continued more quiet; neither did his fever increaſe, as uſually happens when the diſtemper is gaining ground; but all this while his mouth continued ſo much ſhut, that he could neither eat nor drink for three weeks; only by continually rubbing his jaws and neck, he would ſometimes make a ſhift to ſuck a handful of ſcalded bran, or ſometimes a little oat-meal, moiſtened with warm water; but in ſo ſmall a quantity, that it is poſſible he might have ſtarved, if other methods had not been taken to keep him alive.

"I have often obſerved, that the forcing the jaws open by violent means, puts a horſe into ſuch agonies, that it rather increaſes than abates the ſymptoms; and therefore I contrived to give him both food and phyſic by the fundament, through a pipe fourteen inches long, by which he ſeemed to receive great benefit; for we could perceive the ſymptoms to abate daily. His flanks grew more quiet, he ſtood more ſtill, and free from ſudden fits and ſtartings; all which ſymptoms are uſual in the continuance and increaſe of the diſtemper. The clyſters were contrived in the following manner.

"Rue, pennyroyal, and chamomile flowers, of each a handful; ſavin and box, of each a handful; garlic, an ounce; caſtor and aſſafœtida, of each half an ounce.

"In making this clyſter, the herbs are to be boiled firſt, in two quarts of water, in a covered veſſel, the ſpace of ten or fifteen minutes, with the caſtor and aſſafœtida cut in ſmall pieces, and tied in a rag; not only to ſave the caſtor from waſte, but that it may be ſqueezed into ſeveral clyſters. Then the garlic to be added, and continued, cloſe covered, over the fire the ſpace of ten minutes longer; after this the liquor to be poured off into a pan, or any other convenient veſſel; then add of linſeed oil and treacle, of each four ounces, with half an ounce of unrectified oil of amber; the treacle and the oils are to be mixed with the decoction, when it is put into the bag.

"This clyſter was repeated once a-day for a fortnight; and by way of diet, was given every day three or four quarts of milk, boiled with oat meal and water, a bag with a long pipe being left in the ſtable for that purpoſe. He retained every thing that was adminiſtered that way, which he generally ſucked up of himſelf without force. This perhaps was in ſome meaſure owing to the nature of this univerſal convulſion which cauſes ſuch irregular motions in the midriff and muſcles of reſpiration, as in ſome meaſure inverts the natural motion of the guts; and for the ſame reaſon horſes in this condition ſeldom dung, but ſtale often; and when they dung, it drops from them in a manner inſenſibly, and often no more than one or two balls at a time: and therefore as this horſe could receive little or no ſuſtenance by the mouth, I was determined to make trial how far he might receive nouriſhment by way of injection backwards; whether a thin diluted food thrown into the ſtraight gut, and from thence over into the ſmall guts, by the help of a long pipe, might not find a paſſage into the blood through the lacteals, eſpecially the experiments of this kind made on the human body, both in adminiſtering food and phyſic, particularly in giving the bark, by way of clyſter, in agues and intermitting fevers, which has been found ſucceſsful where the ſtomach was not able to bear its auſterity. It was upon this footing that I treated him in the manner I have deſcribed, which I imagined was not altogether without effect; for he ſcarce ate in three weeks what was ſufficient to ſuſtain him one day; ſo that it was impoſſible for him to have lived, had he not been ſupported by what was thrown into his bowels; and though by this means he loſt his fleſh very ſenſibly, yet he ſtill retained a good deal of vigour and vivacity. He had two men conſtantly to look after him, and theſe relieved by others, who had orders to rub his whole body often, which greatly helped to relax his ſkin, and remove the crampneſs of his muſcles; and though he had not for the firſt fortnight recovered the uſe of his jaws, yet we obſerved him daily to move with leſs ſtiffneſs, and often to lick in his manger, as if he craved after food. He alſo breathed with leſs difficulty, and had ſeveral other good ſigns. This encouraged me to try another experiment with opium, from the known quality of that drug in relaxing the animal fibres; which I therefore thought might be of ſervice to remove the contractions of the muſcles about his mouth and jaws, which all this while continued in ſome meaſure obſtinate, and without ſome powerful relief, might prove fatal, even though the original cauſe was in a great meaſure taken away; therefore I cauſed an ounce of crude opium to be diſſolved in one of his clyſters, which was followed with theſe circumſtances, that the horſe ſoon lay down, began to point his ears backwards and forwards, and could move his neck pretty freely, and his mouth was ſo far at liberty, that he took his drink with little or no difficulty, and could eat hay and bran ſufficient to ſuſtain him. He likewiſe moved his whole body ſo readily, that we could walk him an hour every day; and that I might follow what I imagined had been ſo ſucceſsfully begun by the opiate clyſter, I ordered him ſome days after an ounce of the common Matthew's pill, which contains about two drachms of opium, and the ſame quantity of aſſafœtida, made into a ball, which was given at his mouth, and waſhed down with a hornful of gruel, which was done with great eaſe, his mouth being grown pretty pliable. This ball being once more repeated, he recovered daily, being continued for ſome time in the uſe of the drinks, which were now adminiſtered only twice a-week, with a good rubbing; and as ſoon as he began to recover his fleſh, he was gently purged. By theſe means he was perfectly cured, without any other ill effect than a blemiſh upon one eye, cauſed by the violent and ſtrong contraction of the muſcles during the convulſions, which indeed were as bad as any I ever ſaw, even where they proved the moſt fatal."

Diſeaſes.

We have related the above caſe thus particularly, in the author's own words, becauſe we have ſcarcely ever ſeen a caſe of locked-jaw in horſes ſo well deſcribed, both as to its progreſs and treatment. Whatever might have been the cauſe that produced the complaint in this horſe, it was evident that it did not depend upon any congeſtion of blood in the head, and Gibſon judged very properly in not employing bleeding, purging, and rowels, which appear to have been the indiſcriminate practice of farriers in his time; and which might be very proper where the convulſions proceed originally

from

Diſeaſes. from the head. Gibſon ſays, that he has ſeen the farriers in ſuch caſes put a rowel on each ſide of the neck, one on the belly, one on the forehead, and one on each ſide. It appears, however, that this practice met with but little ſucceſs, as in this complaint the ſkin is drawn ſo tight in all parts that the rowels ſeldom ſuppurate kindly, but very commonly produce a mortification, and thus increaſe the animal's diſtreſs.

2. Epilepsy, or Falling-ſickneſs. *Convulſions.*

511 We have already ſtated our opinion, that ſeveral caſes that are commonly called ſtaggers are really inſtances of epilepſy, and we have no doubt that ſeveral ſtrange convulſive diſorders that are deſcribed as affecting domeſtic animals may be referred to the ſame head. Of this kind we conſider the ſkipping complaint among lambs deſcribed by Mr Lawrence: "I remember in former days, (ſays he), on the borders of Suffolk, ſeveral ſcores of lambs were ſeized with an uncommon malady, leaping and jumping about the fold-yard in a ſtrange manner; and a dung-heap being raiſed to the level of the eaves of a low tiled barn, a number of the lambs ran ſkipping up to the top of the roof, as though they had been poſſeſſed by more devils than Mary Magdalen, or even the nuns of Loudun. The whole pariſh wiſely concluded they were bewitched, and a wretched and aged pauper became the object of their ſuſpicions and their deadly hatred. I do not preciſely recollect, but I fear the brutal, ſenſeleſs, and infernal ſuppoſed preventive of witchcraft was recurred to, burning one of the poor animals alive." We ſhould be diſpoſed to account for ſo many animals being ſeized with it at once, on the principle of imitation, juſt as we have ſeen a number of children at ſchool fall into fits from ſeeing one of their number affected with epilepſy. The treatment of this complaint muſt be regulated by the ſtate of the body at the time. If this is plethoric, bleeding, purging, and low diet, will be neceſſary; if it is weak, a ſtrengthening plan muſt be adopted.

3. Canine Madness. Hydrophobia. *Rabies Canina.* La Rage, Fr.

512 Canine madneſs. Of this moſt dreadful malady, the nature of which is ſo little underſtood, and of which the cure ſtill remains a deſideratum in medicine, the accounts hitherto given are very imperfect.

Our principal object ſhould certainly be to aſcertain the origin and progreſs of the ſymptoms, as they appear in the dog, in whom the diſeaſe appears to originate. The account of theſe ſymptoms, as given by different authors, is exceedingly contradictory. The beſt account that we have ſeen is that of Meynell of Quorndon in the county of Leiceſter, and which is publiſhed by Dr Arnold in his account of a caſe of hydrophobia. Before we give Mr Meynell's view of the ſymptoms, we ſhall quote a paſſage from that part of Mr Lawrence's treatiſe on horſes, in which he ſpeaks of canine madneſs. The paſſage is as follows. "The diagnoſtics of canine madneſs are, hunger and thirſt, without power to eat or drink; trembling, eyes fierce and flaming, hanging of the ears and tail, which is bent inwards; lolling of the tongue, foaming, barking of the dog at his own ſhadow, panting, running a ſtraight and heedleſs courſe againſt any thing in his way, biting with violence; other dogs fly him by inſtinct. Diſeaſes.

By comparing the above diagnoſtics with the following account of Mr Meynell's, it will be ſeen how little dependance is to be placed on the deſcription of thoſe who have not written from their own actual obſervation. We doubt not that Mr Lawrence derives his account from what he conceived to be the beſt information, and he is therefore not accountable for his errors.

513 Mr Meynell's account of the ſymptoms. According to Mr Meynell, the firſt ſymptom of canine madneſs in dogs appears to be a failure of appetite in a ſmall degree, that is, the dog does not eat his uſual food with his uſual eagerneſs, though, if better food be offered him, he may eat it greedily. A diſpoſition to quarrel with other dogs comes on early in the diſeaſe. A total loſs of appetite generally ſucceeds, though dogs ſometimes eat and lap water the day before their death, which generally happens between ſeven and ten days after the firſt ſymptoms have appeared. A mad dog will not cry out on being ſtruck, or ſhow any ſign of fear on being threatened; though he will, very late in the diſeaſe, appear ſenſible of kind treatment. A mad dog, in the height of the diſorder, has a diſpoſition to bite all other dogs, animals, or men. When not provoked, he uſually attacks only ſuch as come in his way; but having no fear, it is peculiarly dangerous to ſtrike at or provoke him.

Mad dogs appear to be capable of communicating the infection early in the diſorder, and as ſoon as they begin to quarrel with and bite other dogs.

The eyes of mad dogs do not look red or fierce, but dull, and have a peculiar appearance, which is eaſily diſtinguiſhed by ſuch as have been uſed to obſerve it, but which is not eaſy to be deſcribed.

Mad dogs never bark, but occaſionally utter a moſt diſmal and plaintive howl, expreſſive of extreme diſtreſs, and which they who have once heard can never forget. So that dogs may be known to be going mad without being ſeen, when only this diſmal howl is heard from the kennel.

Mad dogs do not foam or froth at the mouth, but their lips and tongue appear dry and foul or ſlimy.

Mad dogs are generally ſufficiently ſenſible to know thoſe to whom they have been accuſtomed.

Mr Meynell is confident that dread of water is not a ſymptom of this diſeaſe in dogs.

Though mad dogs generally refuſe both food and drink, in the latter ſtage of the diſorder, yet they never ſhow any *abhorrence* or *dread of water*, will paſs through it without difficulty, and lap it eagerly to the laſt. But it is remarkable, that though they will lap water for a long time, and eagerly, and do not ſeem to experience any uneaſineſs from it, yet they do not appear to ſwallow a ſingle drop of it; for however long they may continue lapping it, no diminution of quantity can be perceived.

He has never known a dog ſhew ſymptoms of the diſeaſe in leſs time after the bite than ten days; and he has known many inſtances of dogs having died mad as late as eight months after the bite. The ſymptoms generally appear between three and eight weeks after the bite.

A dog had been bitten, and confined by accident, and

Diſeaſes. and not from any ſuſpicion of danger, for a whole year, ſo as to have no communication with any other dog all the time; and went mad at the end of that period.

Mr Meynell makes the following additional obſervations. "I am perſuaded that the diſorder never originates from hot weather, putrid proviſions, or from any other cauſe but the bite. For however dogs may have been confined, however fed, or whatever may have been the heat of the ſeaſon, I never knew the diſorder commence, without being able to trace it to that cauſe; and it was never introduced into the kennel but by the bite of a mad dog. I do not ſay that I am certain that the diſorder never originated from any cauſe except the bite; but I ſay that I never knew a dog go mad that I had no reaſon to believe had been bitten.

"Some dogs, in the laſt ſtage of the diſorder, have a locked jaw.

"I do not recollect ever to have heard a dog bark after I have perceived ſymptoms of madneſs upon him.

"I conſider an *unuſual diſpoſition to quarrel with other dogs as a certain ſign of beginning madneſs*; and it is the only one I know.

"I believe the diſorder always comes on ſo gradually that miſchief may be prevented by proper care.

"I believe after ſymptoms have ever appeared, they never go entirely off; and that the diſeaſe, though ſometimes very ſlow in its progreſs, always terminates in death.

"Dogs known to have been bitten frequently eſcape, but I believe not near ſo frequently as men.

"Almoſt all the mad dogs that I have ſeen have been confined.

"The hairs of a mad dog do not ſtand erect more than thoſe of other dogs.

"I do not know that there is any thing remarkable in the manner of a mad dog's carrying his head or his tail.

"I do not know that there is any thing fierce in the appearance of the eyes of a mad dog. I believe I ſhould know a mad dog to be mad from the appearance of his eyes, but I cannot deſcribe this appearance.

"I do not know that a dog in the beginning of this diſorder, is diſpoſed to ſneak away growling, or to ſhun the ſociety of other dogs; but if I obſerved any thing particular in the manner of a dog, I ſhould certainly confine him.

"I do not believe that dogs are more afraid of a mad dog than they are of any other dog that ſeems diſpoſed to attack them."

(Mr Daniel was witneſs to an inſtance of this innate dread of a mad dog in other dogs, at Bradwell in Eſſex, where he was hunting with the reverend H. Bate Dudley. Mr Dudley walked his hounds to the water to ſwim them; he had himſelf ſwam over to an iſland about a hundred yards from the ſhore, and moſt of the hounds had followed him, but ſome of them could not be compelled to do ſo. At this juncture an alarm of a mad dog was given, who had been purſued many miles, and done variety of miſchief in his progreſs; he ſeized one of the hounds that would not go into the water, and the remainder to the number of ſeven or eight immediately upon his approach to them, took to the water and ſwam acroſs to thoſe in the iſland *).

* *Daniel's Rural Sports.*

Diſeaſes. "There are two kinds of madneſs, both of which I have known to originate from the bite of the ſame dog. Among huntſmen, one is known by the name of *raging* the other by that of *dumb madneſs*. In dumb madneſs, the nether jaw drops, and fixes; the tongue hangs out of the mouth, and ſlaver drops from it. In raging madneſs, I believe the mouth is ſhut, except when the dog ſnaps or howls, and that no moiſture drops from it." *

* *Arnold on Hydrophobia.* 514

The following facts and obſervations upon the conſequences of the madneſs among Earl Fitzwilliam's hounds, perhaps mark the attack and ſymptoms of this diſorder more accurately than any other deſcription of a ſimilar accident.

In the night of the 8th of June 1791, the man who ſlept in the kennel was unuſually diſturbed by the hounds fighting; he got up to quiet them ſeveral times, and always found the ſame hound quarrelling. Noticing the riotous behaviour of this particular hound, and at the ſame time an appearance of ſtupidity in him, he was induced to ſuppoſe that he was going mad, and accordingly confined him in a place by himſelf, after which the pack was quiet the remainder of the night. When the huntſman came to the kennel in the morning, he was told what paſſed, and the ſuppoſed mad hound ſhewn to him; his appearance was ſuſpicious; ſome meat was given to him, part of which he ate, although there was an apparent difficulty in ſwallowing. Two days paſſed in ſuſpenſe; but at the end of the third, his diſorder was confirmed; and at the end of the fifth day he died mad. Immediate preparations were made for confining 42 couple of hounds ſeparately, until the month of September, which was rigidly adhered to. By this means, Mr Hopkinſon, a medical gentleman of Peterſborough had an opportunity wherein he very ſkilfully and exactly minuted the ſymptoms and progreſs of this diſeaſe.

Six hounds went mad in the following order.

N° 1 attacked	July 1ſt.
2	Auguſt 3d.
3	September 3d.
4	Ditto 4th.
5	November 10th.
6	December 8th.

The hounds were firſt taken from their chains in September, and exerciſed for about half an hour together, not more than four or five couple at a time, and not truſted out of the ſight of the attendant. When this exerciſe was over, they were again confined ſeparately, and fed at ſeparate troughs. In the beginning of October, they were taken out ten couple at a time; at the latter end of that month, twenty couple; ſtill obſerving the ſame caution with reſpect to ſeparate confinement after they returned from exerciſe. In the beginning of November they were hunted, but were chained up, as at firſt, after hunting, until the third week of that month, when they were let looſe in different apartments of one, two, three, four, and five couple together. This regulation was continued till the month of June 1792, as the huntſman, who has had much experience in this diſeaſe did not deem them ſafe under a year.

The only remedy employed was mercurial ointment; and all the hounds, except the bitches that were in whelp,

Diſeaſes. whelp, underwent two frictions, ſo as to produce in ſome of them a violent ſalivation.

Mr Hopkinſon remarks, that from the above ſtatement it ſeems that the diſorder is as virulent, as to the power of inoculation (by which proceſs it is always communicated) at its commencement, as at the advanced ſtage of it; for all the ſix dogs that went mad were probably infected on the 8th of June, within a few hours of each other.

It is a common opinion, that when a dog is bitten by one that is mad, a few weeks confinement, ſea-bathing, or the popular noſtrums, are either of them ſufficient to prevent his taking the diſeaſe, and from ſpreading its miſchievous effects; but in this caſe, there was a fair opportunity of proving that there is no ſecurity after ſix months, perhaps not after twelve; that mercury has no certain power to prevent it; and it appears that the huntſman had repeatedly employed all the popular remedies, without any effect whatever. He had alſo obſerved nearly the ſame progreſs of the diſeaſe in ſeveral packs of hounds, where no expence had been ſpared, for every medicine in uſe, ſea-bathing &c. In the preſent inſtance, there was this remarkable difference, that no internal medicine had been given, and the huntſman never knew fewer hounds attacked with the diſeaſe.

The reſult of the huntſman's experience in the preventive plan is therefore in favour of a ſeparate confinement; for whenever he had depended on medicine, and not on the above plan of treatment, the diſeaſe had made dreadful havock.

There is reaſon to ſuppoſe that the hound which firſt went mad, was not bitten by any other dog, but that it was in him a ſpontaneous diſeaſe. The whole pack were examined very attentively, and bites found upon four couple, one of which was ſeen fighting with the mad hound twice; he underwent a longer confinement than the reſt: however, none of them were attacked by the diſeaſe, and it is ſingular that no bites were diſcovered upon the ſix hounds that went mad. The infection taking place or not, is therefore perhaps the reſult of chance; yet, although no bites were perceived upon the hounds which went mad, there is every ground to conclude they were bitten, but that the wounds being ſmall, were concealed by the hair. Mr Daniel ſuggeſts, that moſt probably there were bites within ſide of the lips, or jaws, where the venomous ſaliva might be more fatally and quickly abſorbed into the habit, than where the teeth had to penetrate through the thick outer ſkin of the dog.

Mr Hopkinſon continues his remarks with reſpect to the ſymptoms of madneſs in dogs, and ſtates that thoſe which diſtinguiſh the attack of the hydrophobia, are in general a loathing of food, although this is not univerſal, as they will ſometimes eat ſolid food, but refuſe liquid. The firſt and only ſymptom that N° 3. had of the diſeaſe, was eating his own excrement when food ſtood by him; the feeder knowing this to be contrary to what the dog would do if he were well, he immediately confined him. For a day or two he was in ſome doubt whether his ſuſpicions were well founded; but he proved right, for the dog died raving mad upon the fifth day.

At the commencement of the diſorder, the mad dog has a particular tendency (if looſe) to lick and ſmell the penis and fundament of another dog; this ſhould be looked upon as a very ſuſpicious ſymptom. The huntſman ſpeaks of this as an almoſt never failing one. Diſeaſes.

There ſeems for the firſt two or three days, to be intervals of ſenſe; and during that time they uſually recogniſe their maſter, their eyes look clear and well, their tongues moiſt, and of the proper colour; but if a dog is looſe at this time, he will in general bite every thing he meets with. He will ſometimes, during this ſtage of the diſeaſe, leave his home for ſeveral hours, ſpread his diſorder by biting men and beaſts, and return home again. The mad dog, when confined, ſeldom ſurvives the fifth day from the firſt attack; if ſuffered to run about, there is reaſon to believe his death is haſtended by a day or two. At the end of the third or fourth day, his appearance is much altered, his eyes are ſunk, his tongue black and dry, he makes horrid howlings, and ſeems much diſturbed; indeed the concluding ſcene is dreadful to witneſs. In the firſt ſtage of the canine madneſs, it is difficult for a perſon not converſant with the diſpoſition of dogs in general, and of the mad dog in particular, to aſcertain whether the dog is really mad or not; even Lord Fitzwilliam's huntſman was doubtful for a day or two reſpecting the hound mentioned in this account, as being the firſt attacked with the diſeaſe; however, in the advanced ſtage of it, no one can be miſtaken.

It is the generally received opinion, that mad dogs will not take the water; but in the ſummer of 1791, there occurred in the neighbourhood of Peterſborough, two inſtances of mad dogs, when cloſely purſued, ſwimming a large navigable river. A doubt might have ariſen, as to their being mad, but that two hogs went mad from the bite of one, and the other was purſued for many miles by Lord Fitzwilliam's huntſman, who, from his experience in the diſeaſe, was not likely to be miſtaken. Both dogs completely ſwam the river *. * *Daniel's Rural Sports.* 515

Of all the remedies that have been employed for the cure of this dreadful diſorder, none ſeems ſo likely to be ſucceſsful as the cold bath. This remedy was recommended about 200 years ago by the Seigneur d'Eſparron, in his "Fauconneric," and he gives a curious inſtance of its ſucceſs in the cure of a mad dog. "I will relate, (ſays he) what happened to a gentleman of my acquaintance. He diſcovered that ſome of his dogs had been bitten by a mad dog; and after ſome time, ſeveral of them betrayed ſymptoms of the diſeaſe. Theſe he ordered to be killed; but it happened that one which was a great favourite was ſeized, and he deſired his ſervant to throw him into the river. By chance, the dog in coming up from the bottom, got entangled in the roots of a tree by the cord with which he had been tied, but in ſuch a manner that his noſe juſt remained above the water. In this ſituation he remained for three days, at the end of which period he got looſe and returned to the houſe, to the great aſtoniſhment of his maſter; and here I afterwards ſaw him, as chearful and healthy as before. I have no doubt (continues d'Eſparron) that if mad dogs could be plunged into water without danger of their biting, they would all recover; and I believe that if the ſame practice were purſued with men, which might eaſily be done, many an unfortunate wretch might be ſaved. The danger of being bitten might be prevented by firſt putting a muzzle on the animal, and he might then be re-

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tained in the water, as long as may be judged prudent or neceſſary. *"

* *D'Eſparron Fauconnerie*, p. 290

Another writer, Deſouilloux, who publiſhed a work on hunting in 1583, recommends plunging into ſalt-water ſuch dogs as have been bitten, for the purpoſe of preſerving them from the effects of the diſeaſe.

As the effect of remedies when the complaint once appears is ſo uncertain, it ſhould be our principal object to uſe all the preventive means in our power. When, therefore, it is diſcovered that an animal has been bitten by one that is mad, the wounded part ſhould immediately be cut out, where this can be done with ſafety, or at leaſt ſhould be deeply ſcarified to the very bottom of the bite. The wound ſhould then be repeatedly waſhed with ſoap and water, or with a ſolution of ſoda poured upon it in a ſtream from a conſiderable height; and afterwards the wound ſhould be ſeared to the bottom with a hot iron; or where this cannot conveniently be done, a quantity of aquafortis, or oil of vitriol, ſhould be poured into it, ſo as to deſtroy all the remains of the virus or poiſon. If the part bitten be the ear, it ſhould be cut off and ſeared. After theſe means, it will be proper to plunge the animal once a day into cold water, or where convenient into the ſea; and he ſhould be ſtrictly watched, that if theſe means ſhould have proved unſucceſsful, the earlieſt appearance of the diſeaſe may be perceived.

Dr Arnold, to whom we are indebted for Mr Meynell's account of the ſymptoms of madneſs in dogs, gives the following advice with reſpect to the method of treating a dog that is ſuſpected of being mad.

516 "Though every dog that is bitten does not receive the diſorder, yet, as the time of its appearance after the bite is ſo very uncertain, and as a great proportion of thoſe that are bitten do actually receive it, and as there is no criterion by which we can aſcertain whether a dog has or has not received the infection, but the breaking out of the diſorder, it is earneſtly to be wiſhed, that all owners of dogs would immediately deſtroy, or ſecure for a great length of time, every dog known, or but ſuſpected, to have been bitten by a mad dog.

"It is alſo earneſtly to be wiſhed, that all perſons poſſeſſing dogs would immediately tie up or deſtroy ſuch of their dogs, whether known to be bitten or not, as ſhall begin to be diſordered in any way, of which the nature and cauſe is not perfectly obvious; and eſpecially if there be the ſmalleſt reaſon to ſuſpect that the dog was bitten, and that the diſorder is really an incipient madneſs.

"It is ſtill more to be wiſhed that they would immediately deſtroy all dogs known to be in any ſtage of madneſs, if it be at the ſame time known that they have not yet bitten any other animal, and particularly no perſon whatſoever; and that no dog that has bitten any animal or perſon be deſtroyed as a mad dog if it can be avoided, but that every dog be ſecured and tied up, that it may be certainly known whether he be mad or not. If he has the ſymptoms of confirmed madneſs, they will plainly diſcover themſelves, and he will die in ten days and leſs; if he is not, he may be ſafely enlarged in the ſpace of a fortnight, and the perſon bitten will be freed from the moſt diſtreſſing apprehenſions." *

* *Arnold on Hydrophobia.*

517 Worming of dogs.

Before we diſmiſs the ſubject of canine madneſs, it will be expected that we ſhould take ſome notice of the operation of worming dogs, ſo celebrated among huntſmen and breeders of dogs, as a ſuppoſed preventive of this dreadful malady. This operation is as old as the days of Pliny, and has ever ſince been more or leſs eſteemed among the vulgar. But neither the operation itſelf, nor its effect, ſeem to have been well underſtood. The idea of a worm being lodged in the tongue of the puppy, the extraction of which is to prevent the animal from going mad, is truly ridiculous; and as ſuch has been deſervedly laughed at by ſenſible people in all ages. But though it is neither a worm that is extracted, nor is the extraction a preventive of madneſs, it ſeems, however, pretty well aſcertained, that the performing of this operation is productive of conſiderable advantage, in preventing the dog from doing miſchief, even though he ſhould run mad. It ſeems, that in dogs who have been wormed, and are afterwards ſeized with hydrophobia, the tongue ſwells to ſuch a degree as to prevent the animal from cloſing his jaws upon the object which he attempts to bite. The following obſervations of a late ingenious and entertaining writer on the ſubject are entitled to much attention.

Very ſtrong proofs have been adduced of its utility; nor is it natural to imagine, that ſo eaſy and effective an operation would have been omitted, had no more virtue been attributed to it than it really poſſeſſes; and, wherein it failed, the abſolute prevention of madneſs was ſaid to be the conſequence; whereas the fact was and is, that taking out the worm hath nothing to do with annihilating the diſorder, although it will moſt certainly hinder the dog, ſeized with it, from doing any hurt to man or beaſt. A late author aſſerts, he had three dogs that were wormed, bit by mad dogs at three ſeveral periods, yet, notwithſtanding they all died mad, they did not bite to do any miſchief. that being determined to make a full experiment, he ſhut one of the dogs up in a kennel, and put to him a dog he did not value; the mad dog often run at the other to bite him, but his tongue ſo ſwelled, that he could not make his teeth meet. The dog was kept in the kennel until the mad one died, and was purpoſely preſerved for two years afterwards, to note the effect, but he never ailed any thing, although no remedies were applied to check any infection that might have been received from the contact of the mad dog.

Mr Daniel has had various opportunities of proving the uſefulneſs of worming, and inſerts three of the moſt ſtriking inſtances, under the hope of inducing its general practice.

A terrier bitch went mad that was kept in the kennel with 40 couple of hounds: not a ſingle one was bitten, nor was ſhe ſeen to offer to bite. The bitch being of peculiar ſort, every attention was paid to her, and the gradations of the diſeaſe (which were extremely rapid) minutely noted. The hydrophobia was faſt approaching before ſhe was ſeparated from the hounds, and ſhe died the ſecond day after. At firſt warm milk was placed before her, which ſhe attempted to lap, but the throat refuſed its functions; from this period ſhe never tried to eat or drink, ſeldom roſe up, or even moved; the tongue ſwelled very much, and long before her death the jaws were diſtended by it.

A ſpaniel was obſerved to be ſeized by a ſtrange dog, and was bit in the lip; the ſervant who ran up to

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Diſeaſes. part them, narrowly eſcaped, as the dog twice flew at him; a few minutes after the dog had quitted the yard, the people who had purſued gave notice of the dog's madneſs, who had made terrible havock in a courſe of ten miles from whence he had ſet off. The ſpaniel was a great favourite, had medicine applied, and every precaution taken; upon the fourteenth day he appeared to loathe his food, and his eyes looked unuſually heavy; the day following he endeavoured to lap milk, but could ſwallow none; from that time the tongue began to ſwell, he moved himſelf but ſeldom, and on the third day he died. For many hours previous to his death, the tongue was ſo enlarged, that the fangs or canine teeth could not meet each other by upwards of an inch.

The hounds were ſome years after parted with, and were ſold in lots. A madneſs broke out in the kennel of the gentleman who purchaſed many of them; and although ſeveral of theſe hounds were bitten and went mad, only one of them ever attempted to bite, and that was a hound from the duke of Portland's, who, in the operation of worming, had the worm broke by his ſtruggling, and was ſo troubleſome that one half of it was ſuffered to remain; the others all died with ſymptoms ſimilar to the terrier and ſpaniel, viz. a violent ſwelling of the tongue, and a ſtupor rendering them nearly motionleſs, and both which ſymptoms ſeemed to increaſe with the diſeaſe.

The idea that worming prevents a dog from receiving the infection when bitten ſhould be exploded; but the foregoing facts ſhow how far it may be recommended for the reſtriction of a malady horrid in its effects where a human being is concerned, and which to the ſportſman and the farmer is attended with ſuch dangerous and expenſive conſequences.

We cannot pretend to ſay, what it is that the wormers of dogs take away from the tongue; but we cannot ſuppoſe, that Mr Daniel, though he calls it a worm, really believes that it is ſo. The following are his directions for performing the operation.

"The *worming* of whelps ſhould be previous to their being ſent out to quarters; this operation is to be performed with a *lancet*, to ſlit the thin ſkin which immediately covers the worm; a ſmall *awl* is then to be introduced under the centre of the worm, to raiſe it up; the further end of the worm will with very little force make its appearance, and with a cloth taking hold of that end, the other will be drawn out eaſily. Care muſt be taken that the *whole* of the worm comes away without breaking; and it rarely breaks, unleſs cut into by the lancet, or wounded by the awl." *

* *Daniel's Rural Sports.*

518 Colic.

4. Colic. Colica. *Spaſmodic* or *Flatulent Colic*, *Gripes*, *Bats*, *Trot*, or *Gulliom*. Tranchée, Fr.

This is one of the moſt painful diſorders with which horſes are affected; and it ſeems to occaſion them as much diſtreſs as inflammation in the bowels, with which it is very commonly confounded by ordinary farriers.

In this diſeaſe the horſe expreſſes his pain, by frequently lying down and rolling on his back, and after having remained a ſhort time in this poſition, ſtarting up again. The hair is ſtaring, and there are ſometimes cold ſweats. He frequently makes attempts to ſtale, looks anxiouſly at his flanks, and ſometimes ſtrikes his belly with his hind feet. There is ſeldom any fever in this diſeaſe; and when it does occur, it is only after the diſeaſe has exiſted for ſome time. The pulſe is ſeldom affected; but when the pain is very great, it is a little quicker than natural. The belly commonly feels hard and tenſe. Colic is almoſt always accompanied with coſtiveneſs, though griping pains not unfrequently attend ſevere ſcouring. Diſeaſes

If the above ſymptoms are attentively examined, they will commonly ſerve to diſtinguiſh this diſeaſe from inflammation of the bowels. It is generally obſerved, that the pain in colic returns only at intervals, and the extremities are ſeldom cold. It muſt not be overlooked however, that when colic continues for a conſiderable time, it may terminate in inflammation, ſo that the diſtinguiſhing ſymptoms mentioned here and in N° 497. are to be depended on, only in the early ſtage of the diſeaſe.

Cattle are extremely ſubject to colic; but it is ſaid to be more common in young than in old cattle. The ſymptoms do not differ from what we have deſcribed, only that it is ſaid, that theſe animals, when affected with gripes, ſtrike their heads and horns againſt every thing in their way.

Colic is eaſily removed, when the proper remedies are employed, before any ſymptoms of inflammation make their appearance; but if the remedies be delayed till inflammation takes place, the cure is very precarious.

Colic is very commonly the conſequence of neglected coſtiveneſs, and by this it is always increaſed. It may be aſcribed to improper food, eſpecially ſuch as is apt to produce flatulence or ſourneſs in the ſtomach or bowels; by drinking cold water immediately after eating; and by expoſure to cold, during violent ſweating.

As it is not always eaſy to diſtinguiſh flatulent colic from inflammation, it is the ſafeſt plan to begin the treatment by bleeding, to the extent of three or four Engliſh quarts; and the appearance of the blood will generally inform us whether it will be neceſſary to repeat the operation. See N° 162. The next circumſtance to be attended to, is the evacuation of the bowels by back-raking and ſoftening clyſters. In general, after this operation, a large quantity of air will be evacuated, and conſiderable relief will be afforded. After theſe means have been employed, ſome ſtimulating aromatics, ſuch as oil of turpentine, oil of aniſeſeed, eſſence of peppermint, or ſome of the other ſtimulants enumerated in N° 285, and 286, ſhould be given by the mouth; and if theſe do not procure relief, it will be proper to give a ball containing half an ounce of calomel, and immediately after it, a drench of peppermint water, with five or ſix drachms of laudanum. The cure will be conſiderably aſſiſted by rubbing the belly gently with a warm cloth; and the animal ſhould be gently trotted, for a conſiderable time, while led by the halter. Warm fomentations to the belly have been recommended; but if there is a conſiderable accumulation of air in the ſtomach and bowels, theſe would do harm by increaſing the expanſion of the air, and thus adding to the animal's diſtreſs; for it muſt be remembered, that a horſe cannot eaſily belch up wind by the mouth; and where there is any obſtruction backwards, every thing that can increaſe the

Diſeaſes. expanſion of the confined air, muſt do harm. On the contrary, every thing that is capable of diminiſhing the volume of air, may probably relieve the pain. It might be worth while to try how far the application of cold to the belly would be attended with advantage; and this might eaſily and ſafely be effected, by bathing the belly with ſtrong ſpirit of wine, which ſpeedily evaporating, will conſiderably diminiſh the temperature of the belly. It will be proper, where the diſeaſe continues obſtinate, to adminiſter warm ſoftening clyſters, every hour or two; as well for the purpoſe of obviating coſtiveneſs, as for removing the ſpaſmodic conſtriction of the bowels. We are aſſured, that where moſt other means have failed, of procuring relief in flatulent colic, this has been obtained by means of the ſmoke of tobacco drawn up the fundament. The ſimpleſt way of adminiſtering this remedy, is to introduce the ſmall end of a tobacco pipe, after having filled the bowl and lighted it; when the ſmoke will inſenſibly be drawn up by the action of the horſe's bowels.

Chap. V. *Of Dropſical Diſeaſes.*

519 Dropſy. Our domeſtic animals are ſometimes affected with dropſy; and this may be either diffuſed through the cellular membrane below the ſkin; or the water may be contained within one or more of the cavities, as the head, the cheſt, and the belly.

520 Water farcy. External dropſy, or what medical writers call *anaſarca*, and farriers *water farcy*, is not common, unleſs it accompanies a dropſical collection within the body. It ſometimes affects particular parts, as the legs, the ſheath, or the lips; and at other times it is diffuſed over the whole cellular membrane. It is known by the ſwelling of the part, which is cold, and retains the impreſſion of the finger for ſome time. The urine is generally more ſparing and of a deeper colour than is natural; and the animal appears conſiderably weak. This diſeaſe, when it has proceeded to any conſiderable height, and when the animal is much debilitated, is not eaſily removed; but when it is ſlight, and of no long ſtanding, it will in general yield to remedies.

All the ſpecies of dropſy more commonly affect old than young animals; and ſuch as are debilitated by any previous cauſe, are more ſubject to it. It is ſaid that horſes are more likely to become dropſical in ſpring and autumn when they are moulting.

The cure of general dropſy is to be attempted by the uſe of diuretic medicines, accompanied with a nouriſhing diet, gentle exerciſe, and frequent friction all over the body, eſpecially over thoſe parts where the accumulation of fluid is ſituated. The action of the diuretics muſt be aſſiſted by a ſufficient quantity of drink; and it will be proper to give the animal ſome of the more powerful ſtrengthening remedies, ſuch as white vitriol, oak bark, logwood, &c.

521 1. Dropsy of the Head. Hydrocephalus. *Sturdy. Turnſick.*

Dropſy of the head ſeldom affects horſes or cattle; but a peculiar collection of water in the head is very common among ſheep, in whom it is called the *Sturdy*, or *Turnſick*. One of the beſt accounts of this diſeaſe that we have ſeen is that which is given in the ſecond appendix to Mr Findlater's ſurvey of Peebles, which we ſhall give nearly in the words of the author. Diſeaſes.

This diſeaſe is peculiarly incident to young ſheep, or hogs, of a year or eighteen months old. It conſiſts of a collection of water generally formed upon the external ſurface of the brain, immediately below the ſkull; and ſometimes, though not often, in the center or ventricles of the brain. When the water forms in the laſt mentioned parts, we apprehend it is almoſt univerſally mortal.

The diſorder is firſt diſcovered, by the animal not keeping up with the reſt of the flock, and by its appearing dull and ſtupid. It is afterwards obſerved to go round in a giddy manner; and at length it appears blind, and the pupil of the eye ſeems wide and relaxed. It may continue a long time in this ſituation before it dies; and it is believed that ſheep ſometimes recover of this diſeaſe without any thing being done for them. They are often in good order when they die, as they continue to feed tolerably well, until near the laſt period. Though ſome recover, with or without means, perhaps it may be moſt adviſable to kill them early in the diſeaſe, provided they be in good order, as this local diſtemper does not affect the goodneſs of the mutton.

When the collection of water is on the outſide of the brain, it is often cured by thruſting a ſharp wire up the animal's noſtrils, until it reaches the water, and opens a paſſage for it to run off. In other caſes, it is cured by an operation which ſome ſhepherds perform very dexterouſly. The water is contained in a bladder, or veſicle, (a *hydatid*) generally about the ſize of a walnut. The part of the ſkull immediately above where it is ſituated, feels ſofter than other parts. This the ſhepherd diſcovers, by preſſing with his thumb and fingers, upon different parts of the fore and upper parts of the ſkull. The bone here has become thinner, and feels ſoft; from which he is certain that the watery collection is formed. After the diſeaſe has gone on a conſiderable time, and he judges it ripe for the operation, he raiſes the ſcalp, and lays the bone bare to a ſufficient breadth, with a ſharp knife; he then diſcovers more accurately the extent of the thin ſoft part of the bone, and with a ſtrong and ſharp-pointed knife, he makes a circular inciſion in the ſkull, raiſes up, and takes out the part. He then ſees the clear thin bladder underneath, which he lays hold of with a ſmall hook, or the point of a needle, and gently draws it out; taking all poſſible care that it be not broken, or the water ſpilled, which would prove unfavourable to recovery. He finds a conſiderable hollow in the brain where the bag was ſituated, over which he brings the flap of ſkin that was raiſed, ſo as to cover it as neatly as poſſible. Over the whole he applies a plaſter of tar, and leaves the reſt to nature. This operation frequently proves ſucceſsful.

Mr Findlater remarks, that in Tweeddale, one caſe in three, where a perforation is made by the pointed wire, or the trepan, uſually ends favourably. Of late it has been the cuſtom among the ſhepherds of that diſtrict, to bore into the ſkull of ſheep affected with the ſturdy, with a common gimblet; and however rough or apparently dangerous the operation, it ſeems frequently to prove ſucceſsful. The perforation is made by boring from the root of the noſtril, in an oblique direction

Diſeaſes. direction to the root of the horn on the oppoſite ſide of the head.

2. WATER in the CHEST. Hydrothorax.

522 Dropſy of the cheſt. This complaint appears but ſeldom in the inferior animals: but it may take place from exceſſive debility; and according to Mr Blaine, it is ſometimes the conſequence of inflammation in the lungs. Here however this writer is probably miſtaken, and confounds water in the cheſt with *empyema*, or a collection of matter within the cheſt, which is not an uncommon termination of *pneumonia*.

When dropſy in the cheſt does occur, the animal labours under a difficulty of breathing, eſpecially when lying down; and the pulſe is feeble, and commonly irregular. The urine is ſcanty and high coloured. If the collection of water is pretty conſiderable, it may be perceived by the ſound that is produced, when the cheſt is ſtruck with the hand; but this is often a deceitful ſign, and ſhould not be tried till a long time after the animal has drunk; as, for ſome time after drinking, the water that remains in the ſtomach will, when the ribs are ſtruck, produce a ſound that might lead us to ſuppoſe there was water in the cheſt.

This complaint commonly proves fatal, both in man and animals, and probably there is no means of cure except by evacuating the water, by an opening into the cheſt; an operation which is always precarious, and commonly as dangerous as the diſeaſe which it is intended to relieve. If it is determined however to try the experiment, the opening ſhould be made between the ſeventh and eighth rib, near the breaſt bone, on that ſide of the cheſt where the water is ſuppoſed to be accumulated. In making the opening, the ſkin ſhould be drawn tight towards the edge of the ſeventh rib; when a cut is to be made in the place above directed, with a ſharp knife, not cutting too boldly, but rather ſcratching with the point of the knife, till the ſkin and the muſcles are completely divided. After this, a pipe muſt be introduced through the opening, and faſtened by a bandage round the animal; ſome ſoft linen or a piece of ſponge being placed over the opening, after as much water as poſſible has run off, to ſuck up the remaining moiſture, and exclude the air.

3. WATER in the BELLY. Aſcites.

523 Dropſy of the belly. This is the moſt common ſpecies of dropſy, and is known by the general ſymptoms of dropſy that have been deſcribed in N° 319. and 320. attended with an unuſual ſwelling of the belly; while the ſkin is cold, and very tight. When the belly is ſtruck with one hand, while the other is held upon the oppoſite ſide, a fluctuation may be perceived, much more diſtinctly than in the laſt ſpecies.

It is brought on by the uſual cauſes of dropſy that we have already mentioned, and is not an uncommon conſequence of jaundice and other chronic diſorders. It is not quite ſo dangerous as dropſy in the cheſt, but it is very apt to return after having been removed.

The treatment ſhould be begun with diuretics, and now and then a mercurial purge, while the body is ſtrengthened by tonic medicines, nouriſhing diet, and gentle exerciſe. If the accumulation of water becomes very great, it may be eaſily evacuated, by making a puncture into the belly, and introducing a pipe as in the laſt caſe. Mr Lawrence has gone into the miſtake generally committed, of ſuppoſing that little drink ſhould be given in caſes of dropſy. It is now well aſcertained that moderate drinking conſiderably increaſes the efficacy of diuretic medicines. Diſeaſes.

CHAP. VI. *Of Anomalous Diſeaſes.*

1. DIABETES. *Profuſe Staling*, or *Piſſing-evil.*

524 Profuſe ſtaling. It ſometimes happens, that horſes or cattle make a much greater quantity of urine than is natural; ſo that the quantity evacuated exceeds the quantity of fluid drunk by the animal. Probably this diſeaſe occurs more frequently among cattle than among horſes, though it is ſcarcely mentioned by the writers on cattle medicine, and the account that is given of it by veterinary writers is extremely imperfect. Mr Blaine deſcribes the urine, as being five or ſix times the natural quantity, as milky or watery, and depoſiting a ſediment which has the taſte and appearance of ſugar. As we have never obſerved a caſe of this diſeaſe in horſes or cattle, we cannot ſay how far this deſcription of the urine is correct; but if the urine evacuated by theſe animals in *diabetes* reſembles the human urine in the ſame diſeaſe, it is clear and almoſt colourleſs, has the ſmell and taſte of honey, depoſits little ſediment, but on being evaporated, leaves a thick ſubſtance like treacle.

Conſiderable thirſt accompanies this diſeaſe; and when it has continued long, the animal becomes extremely weak and emaciated. The ſkin is uſually dry and harſh, the pulſe is ſmall and quick, and the appetite in the early part of the diſeaſe is much increaſed.

This complaint commonly proves fatal; few inſtances of a recovery having been obſerved in man; and we do not know that any ſucceſsful caſe in any of the domeſtic animals is on record.

The cauſes of *diabetes* are very obſcure, eſpecially in the inferior animals; it ſeems to be the conſequence of great weakneſs, and ſome unuſual action of the digeſtive organs. The various theories that have been given in explanation of this diſeaſe, as far as relates to the human body, will be noticed in the article MEDICINE and if we ſhall meet with an opportunity of examining the diſeaſe in horſes or cattle, we will endeavour to give a more accurate account of it, under VETERINARY *Art.*

In the treatment of *diabetes* in horſes, &c, the method propoſed by Dr Rollo for the cure of this diſeaſe in man, has been recommended, and we believe adopted, by Mr Coleman; with what ſucceſs we cannot ſay. This method conſiſts in making the animal abſtain as much as poſſible from vegetable food; and giving him broth and balls made of fleſh, mixed up with paſte of wheat flour. He ſhould have as little drink as poſſible. Aſtringent remedies are commonly employed in theſe caſes, ſuch as Japan earth, alum, white vitriol, muriate of iron, oak bark. See receipts, N° 29.

2. BLACK-QUARTER, QUARTER-ILL, or BLACK SPALD.

525 Quarter-ill. There is a diſeaſe that proves very fatal in ſome diſtricts to calves or cattle of a year to two old, the nature of which is little underſtood, but it ſeems nearly allied

Diſeaſes. allied to the *Hawkes* or *Hacks*, deſcribed in N° 428. Mr Lawrence conſiders the diſeaſe as appearing under various forms, to which he gives the following names; *ſhewt of blood; vomit of blood; blood in the back; blood in the legs*, or *crateuch; blain in the tongue*, or *overflow of blood; ſtriking-in*, or *riſing of the blood*; *higham*, or *iron-ſtriking; joint murrain*, or *garget; black quarter; quarter-evil; black leg.*

We have given as a ſynonym the name of *black ſpald*, becauſe we conſider the diſeaſe ſo called in Scotland, as nearly, if not entirely, the ſame with the *black quarter* of the writers on cattle medicine. As we have not ſeen the diſeaſe, we ſhall copy what Mr Lawrence ſays of it, in his treatiſe on cattle.

"All our animals, oxen, ſheep, and pigs, I have obſerved, are ſubject to ſanguineous effuſion or overflow of the blood, on being put in a low and weak ſtate, to rich or ſucculent keep. They very commonly drop on a ſudden, and die in the blood, as it is termed; when the carcaſes putrify almoſt immediately, and are totally loſt. Pigs which die in this way, have their ſkins ſo univerſally ſuffuſed with the blood, that they appear enveloped, or rather ſhrouded in Morocco leather. In oxen, chiefly young cattle, nature commonly finds a vent for the diſeaſe, in an eruption on the leg, quarter, or ſhoulder, attended with *pneumatoſis* or a collection of air in the cellular membrane, or, as it is commonly termed, between the fleſh and the ſkin; whence the crepitating or crackling noiſe, which is heard on preſſure. Another termination of the diſeaſe, is, by a depoſition of matter upon the joints, whence the term of joint garget or murrain. I know not whether I am correct in referring the *crateuch* to this claſs, which is ſaid, in Scotland, to be a ſwelling and lameneſs in the legs; but the old writers particularly mention *blood in the legs*. *Blane* or *garget in the tongue*, attended with inflammation and veſicles or bladders in that part, is ſaid to be a ſymptom of the diſeaſe, and alſo to ariſe from heat and fatigue.

"This diſeaſe has ſwept off great numbers of yearling and two-year-old cattle, and become indeed endemial in certain diſtricts, where any ſuch ſcourge was unknown, it is ſaid, previouſly to the introduction of artificial graſſes, with the full feeding on which the animals become ſurfeited: thus the improvident uſe of good produces evil. The breeders being alarmed at the ravages occaſioned by this murrain, which generally carried off the forwardeſt and beſt of the cattle, no wonder that the fertile brains of cow-doctors, were put into inteſtine motion, and that the ideas of the favourite engines, the knife or fire, were whirled uppermoſt. In effect, ſome ſkilful leech introduced the following moſt extraordinary operation, as a preventive of the diſeaſe in queſtion; which I apprehend in the contemplation, either of phyſiology or common-ſenſology, could have no better prophylactic or preventive view, than ſhaving the animal would have; which I beg leave to recommend in the ſtead, as at leaſt free from cruelty. The ill-ſtarred beaſt is caſt, bound to a ſtake, all his four legs are cut open from the claws upwards to the height of ſeveral inches, in order to find among the tendons and ligaments a ſtrong blood veſſel of a bluiſh colour, which ſaid offending veſſel, guilty of the original ſin of producing joint murrain, being caught with a crooked needle, is cut away. It is great pity, for the ſake of hypothetical uniformity, that the above-ſaid blue blood-veſſel had not been called a worm, ſince the brains of ſo many of our cattle folk have been infeſted with worms from very high antiquity *".

Diſeaſes.

* *Lawrence on Cattle*, p. 584.

After much jocoſe, but rather coarſe ridicule of methods that have been propoſed for the cure of this diſeaſe, Mr Lawrence thus proceeds. "Prevention of this malady is the only cure worth notice: becauſe, after the attack, the very nature of the caſe renders all remedy either uncertain, or of very little profit, even if ſucceſsful, on account of the expence of time and money. With this view the young cattle muſt not be puſhed ſo forward in condition; and indeed the ſame precaution may be uſeful in ſome degree, with reſpect to the full aged. A piece of ſhort or inferior keep ſhould be reſerved, as a *digeſting place*, in which the cattle may be occaſionally turned to empty and exerciſe themſelves. Thoſe obſerved to advance very faſt may be bled monthly for ſeveral months: of the efficacy of which practice, however, I have by no means ſo good an opinion as that of giving medicines which prevent internal obſtruction. I am well aware of the difficulty, or rather total impracticablity, of ſuch meaſures with a number of cattle in the field, or I am convinced, that occaſional purges, or alterative medicines, would prevent thoſe diſeaſes which ſeem to take their riſe in over repletion and accumulation. Six drachms, daily, of equal parts, ſulphur and antimony, in fine powder, would be ſufficient for a young beaſt; but to be of any permanent uſe, it muſt be continued at leaſt a month; or ſalt might be of uſe. Rowelling alſo might be an efficacious preventative. Keep two rowels or ſetons open in each beaſt during ſeveral months." *

In the 5th vol. of the Farmers Magazine, is the following communication from a practical farmer reſpecting the cure of this complaint.

† *Ibid.* p. 588.

"The firſt cure for this complaint that I ever ſaw performed, was on an ox of four and a half years of age. As he was going in the plough, I obſerved him a little lame in one of the hinder feet. At firſt I thought he had trampled upon a ſtone; but as it ſtill grew worſe, I ſoon ſuſpected it was the quarter-ill; the more ſo, as there was a good year-old died of that diſorder three weeks before. By the time he was got to the byre, the crackling between the ſkin and the fleſh was very perceptible on the top joint of the off-ſide hinder leg. As our blackſmith had ſome ſkill among live ſtock, he was inſtantly ſent for. The firſt thing he did was to take a little blood from a vein in the neck. He then pulled the ſkin from the fleſh on the ſide that ſeemed moſt pained, ſtill keeping the beaſt walking as much as poſſible. He then cauſed cold water to be poured in large quantities on the part affected, ſtill rubbing and keeping the ſkin looſe on the affected part. Finding the ſkin to adhere much to the fleſh, he then made three cuts with a penknife, two inches long, into which he rubbed ſalt and water. In this manner he continued four hours; the one time driving him, then pouring on water, rubbing in ſalt, and looſening the ſkin from the fleſh. By this time he was not near ſo cripple, and began to take his food. We were ordered, however, to keep him in motion all night, and in the morning he was well for his food, and never had any more ſigns of the diſeaſe. Since that time I have followed the blackſmith's practice, and have often been ſucceſsful. Only inſtead of pouring water on the place, I faſten a rope

Diſeaſes. rope about the beaſt's head, and take it to a deep pool, cauſing it to ſwim up and down, and drive it frequently, giving it an ounce or half an ounce of laudanum, according to the ſize or age of the beaſt, but I never did cut the ſkin. I have good reaſon to believe that the above method has been the means of curing ſeveral of my young cattle, as I never ſaw any that took that diſeaſe, and no means uſed for their recovery, but died; thoſe I opened, had all the blood collected in the affected quarter. I find it more difficult to cure in the fore quarters than in the hinder, and if it ſeize the bowels, I hardly think that it will cure by any means."

3. On the ROT in SHEEP. *General or True Rot.* Hydropic Rot.

526 Rot in ſheep.

The name of the rot in ſheep, and the ravages that are annually made by it among the flocks of moiſt ſheep diſtricts, are familiar to every one; but little pains have been taken to fix the preciſe meaning of the word, and the particular diſeaſe, to denote which it ſhould be excluſively employed. Some of thoſe who appear to have paid particular attention to the ſubject, have yet followed the example of ſhepherds and farmers, in confounding under the name of *rot*, ſeveral diſeaſes which differ conſiderably in their nature, cauſes, and method of treatment. Two medical men who have lately publiſhed; the one, Dr Dickſon, on the General Management of Sheep, as connected with practical agriculture; the other, Dr Harriſon, on this particular ſubject of the *rot*, have ſtill conſidered it as one diſeaſe. In the ſecond appendix to Mr Findlater's Survey of Peebles, and in the fourth number of the Edinburgh Medical and Surgical Journal, the diſtinction of the rot into three different morbid affections, is, however, clearly marked; and there ſeems no doubt that theſe three diſeaſes are very ſimilar to conſumption, hepatitis or inflammation of the liver, and ſcurvy, in the human body. The firſt of thoſe which we have briefly noticed in N° 490. under the name of *pulmonic rot*, is diſtinguiſhed by cough, hectic fever, waſting of fleſh, and in many caſes by the formation of a watery ſwelling below the chin. The ſecond, mentioned by the name of *hepatic rot* in N° 493. is characterized by a degree of fever accompanied by inflammation, and thickening of the outer coat of the liver, or ſome diſeaſed ſtate of the biliary ducts or pipes, connected with the preſence of flukes in the liver, if not ſometimes produced by them. The third ſpecies has been called *general rot*, as in this the whole ſyſtem is more or leſs affected; *true rot*, becauſe it appears to be the moſt common of the three, and to be that to which the name ſeems more peculiarly applicable; and *hydropic rot*; becauſe, if the animal is ſuffered to live, the diſeaſe commonly terminates in partial or general dropſy. This ſpecies is what we are now to conſider; and after having given as clear an account of it as we can collect from the deſcriptions that have been lately publiſhed, we ſhall make a few obſervations on the cauſes, treatment, and prevention of the *rot in general*, endeavouring as much as poſſible to diſcriminate between the three varieties.

527 Symptoms of general rot.

It is probable that the firſt ſymptoms of the rot have ſeldom been obſerved. The earlieſt marks of the diſeaſe of which writers give an account, are, falling off in fleſh, and an unuſual dullneſs and heavineſs. The fleſh feels looſe and flabby, eſpecially about the loins; and if preſſure is made about the hips, a crackling is ſometimes perceptible. It is ſaid that thoſe who are accuſtomed to handle the ears and legs of ſheep, may in the earlieſt ſtage of rot diſcover ſymptoms of *low fever*, but probably this is the caſe only in *pulmonic* and *hepatic rot*. Now, or ſoon afterwards, the countenance looks pale, as do the gums and tongue. On parting the fleece, the ſkin is found to have loſt its fine roſy colour, and is become of a pale red. As the diſeaſe advances, the ſkin appears dappled with yellow and black ſpots. The eyes have a peculiar appearance; they loſe their luſtre, and look like the eyes of dead fiſh. Mr Findlater ſays, that in Tweeddale, the principal mark of rottenneſs is taken from the appearance of the eye in the corner next the noſe, when the eyeball is turned ſo as to look away from the noſe; as the fleſh that adheres to the eyeball below the eyelids, in the corner next the noſe, is in a ſound ſheep of a florid red colour; whereas in a rotten ſheep, the fleſh is of a dull appearance, and of a yellowiſh red colour, reſembling that of a rotten egg, when the white and the yolk are confounded together. When the diſeaſe has continued long, the breath becomes fetid, the gums ſpongy, the teeth and ſometimes the horns looſe, the animal is commonly affected with a ſcouring, the fleece looks torn and ragged, and the wool ſeparates from the ſkin with a ſlight pull. Great weakneſs and emaciation attend the latter ſtage of the diſeaſe; and theſe continually increaſe till the animal dies, or till dropſy comes on, which always terminates fatally. Diſeaſes.

The principal appearance on diſſection is preſented by the liver, which is found in various ſtates, according to the progreſs or ſeverity of the diſeaſe. When a ſheep is killed a few days after contracting the rot, the thin edge of the ſmall lobe of the liver appears of a tranſparent white or bluiſh colour, and this colour ſpreads to a greater extent according to the ſeverity of the complaint. Sometimes it does not extend more than an inch from the edge; at others it occupies a conſiderable part of the lobe. In ſevere caſes, the whole external coat of the liver is found diſeaſed, commonly aſſuming an opaque colour interſperſed with lines or patches of a darker red. The upper part of the liver is ſometimes found ſpeckled like the back of a toad, to which it is ſaid to bear a ſtriking reſemblance. Very commonly the liver is found full of hard knots, and ſometimes there are ulcers in various parts of it. Are not ſome of theſe appearances peculiar to the hepatic rot? When the liver of a ſheep affected with the rot is boiled, it loſes its conſiſtency, and breaks down into ſmall pieces; whereas it is well known that a ſound liver becomes by the ſame proceſs firm and ſolid.

When ſheep have died ſuddenly in the firſt ſtage of this diſorder, there may commonly be diſcovered a quantity of wheyiſh-coloured fluid in the cavity of the belly; and in theſe caſes the outſide of the liver is generally covered with a coat of coagulable lymph. This is one of the appearances deſcribed by Dr Harriſon; and is ſimilar to what is often obſerved in the belly of animals that have died of dropſy in the belly.

In ſtating the cauſes and treatment of *general rot*, we cannot perhaps do better than copy what is given on this ſubject in Mr Findlater's ſurvey of Peebles, to 528

which

Diſeaſes.

which we have already been ſo much obliged. " It ariſes from deficient or bad aliment, whether the food itſelf be bad and ſcanty, or the animal be incapable of digeſting it properly. It is moſt common from the former cauſe, want of food; and the diſeaſe is much the ſame with ſcurvy among the human race. In addition to theſe cauſes, whatever tends to depreſs the ſpirits, frequently excites, or at leaſt exaſperates, the malady. It is ſaid that ſoldiers in a garriſon have been known to be ſeized with the ſcurvy on hearing bad news; and I doubt not but terrifying ſheep with dogs, or other means, may produce or aggravate this diſeaſe. We may hence ſee what miſchief a fox chaſe, or any exhibition of that ſort, is calculated to bring upon a flock of ſheep. The diſeaſe is alſo ſaid to be produced by feeding upon watered graſs; and hence ſhepherds, in many parts of Scotland, are careful to keep off their ſheep from the tender graſs produced by the occaſional overflowing of rivulets. Feeding alſo in marſhy and damp paſtures, is known to be a powerful cauſe of the rot.

" The only means of cure are, a ſupply of good and wholeſome food, and invigorating the ſtomach by permitting the animal to feed on thoſe ſtimulating and aromatic herbs which are agreeable to its taſte. It is believed that on dry ſweet paſtures, where there is a ſufficient quantity of furze and broom, juniper, and other ſhrubs that are palatable to ſheep, the rot is ſeldom heard of. When ground is ſown down for ſheep paſture, parſley, thyme, peppermint, and other aromatic herbs, ſhould be ſown with the graſs ſeeds, as theſe plants ſerve both to prevent and to cure the rot. In addition to theſe means of cure, every thing that tends to annoy or depreſs the animal in its weakly ſtate ought to be avoided.*

* *Findlater's Survey*, p. 404.

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The following facts with reſpect to the production of rot, conſidered as a general diſeaſe, are chiefly taken from Dr Harriſon's Inquiry.

Poor, clayey, and loamy lands are moſt ſubject to rot.

Grounds that are always dry, or always under water, and ſuch as are always ſufficiently wet to preſerve a conſtant running of water, were never known to ſuffer from the rot.

Ponds of living water are equally ſafe; but when attempts to drain lands have been made, and have not fully ſucceeded, ſheep which feed on ſuch lands are very much expoſed to the rot.

Grounds newly laid down for paſture, or ploughed fields that have been exhauſted by repeated crops, where the ſward is thin, and where the water remains in plaſhes for want of proper outlets, are peculiarly ſubject to the rot.

Marſhes that are overflowed by the ſea, and boggy ſituations, eſpecially in Ireland, are ſeldom known to rot.

Lands that have been limed, and many ſoils that are chiefly compoſed of calcareous matter, are conſidered as very likely to produce the rot.

Ewes that are with lamb, or are giving ſuck, are leſs liable than other ſheep to be affected with the rot.

Eight cauſes have been aſſigned for the production of rot, viz.

1. A vitiated dew. It is ſtated in the ſurvey of Lincolnſhire, that a ſhepherd, who when young, was ſhepherd's boy to an old man that lived at Nettlam near Lincoln, a place famous for the rot, declared his perſuaſion that ſheep took the rot, only in a morning before the dew was well off. His maſter's ſhepherd always kept his flock in fold till the dew was gone, and with only this attention his ſheep were kept ſound when all his neighbours loſt their flocks. Dr Harriſon remarks, that if this cauſe were juſt, the rot ſhould appear equally on all lands.

Diſeaſes.

2. The diſeaſe has been attributed to a gruſt or earthy ſediment that adheres to the graſs after wet weather, or after the overflowing of running water.

3. It has been ſuppoſed to be owing to the luxuriant and quick growing herbage that is produced in hot moiſt ſeaſons. But all luxuriant paſtures do not produce the rot.

4. It has been attributed to the ſheep grazing on ſome particular herbs, ſuch as the butterwort (*pinguicula vulgaris*), the white rot (*hydrocotyle vulgaris*), round-leaved ſundew (*droſera rotundifolia*), and long-leaved ſundew (*droſera longifolia*); but theſe plants do not grow on every rotting ſoil.

5. The diſorder has been imputed to flukes in the liver. We have already ſtated our opinion, that flukes may produce the hepatic rot.

6. The rot has been ſuppoſed to depend on the infection of *ſheep-pox*. This opinion ſeems to have ariſen from a confuſion of terms.

7. M. Daubenton conſidered the diſeaſe to be produced by poverty of food, and too much water. There is no doubt that theſe cauſes commonly produce the laſt ſpecies of rot which we have mentioned.

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8. Dr Harriſon is of opinion that the rot is always generated by the exhalation or effluvia produced by the action of the ſun's rays on ſoils that are partially covered with ſtagnant water. After adducing a number of ingenious arguments in ſupport of his opinion, Dr Harriſon ſums up the amount of his doctrine in the following manner.

Dr Harriſon's theory of the rot.

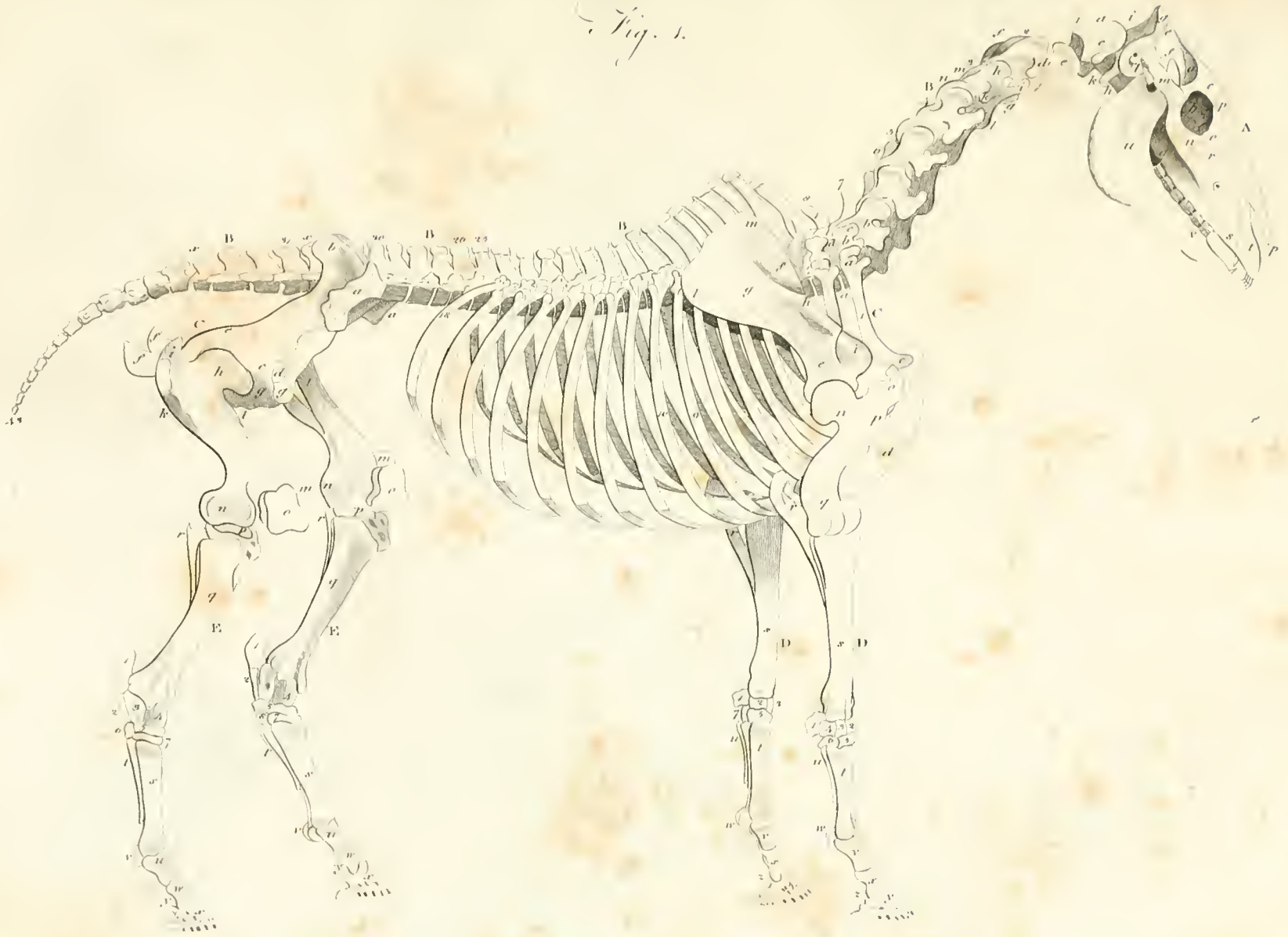
" From the various circumſtances enumerated, I think I am juſtified in attributing the rot in ſheep and other animals to paludal effluvia; but with reſpect to their nature and conſtitution, it is very difficult to form any rational judgment, as they have hitherto eluded the moſt ſubtle and delicate inquiries. It muſt, however, be admitted, *ſi cauſa latet, vis eſt notiſſima*; and conſequently the ſubject, from its great importance to the public in general, is entitled to a ſerious inveſtigation.

" Without heat and moiſture, no deleterious vapours can be generated; and yet it is equally certain, that both theſe cauſes are inſufficient to produce either a recurrent fever, or the rot, ſince they are confined to particular ſituations. Other auxiliaries are therefore neceſſary; and I am inclined to believe that vegetable or earthy particles, and probably both, are required, as well as heat and moiſture, to conſtitute the noxious emanations or gaſſes called *miaſmata paludum*.

" Probably it will be found, on further inquiry, that a great variety of animal and vegetable effluvia are extricated in different places; and that many diſorders ſhould be attributed to them, which are at this time imputed to other cauſes.

" Poiſonous vapours are extremely active and ſudden in their effects, of which proofs may be found in the hiſtory

Fig. 1.



J. Abbott Print. Mad.e to Matter. Grad.

Fig. 2.

Fig. 4.

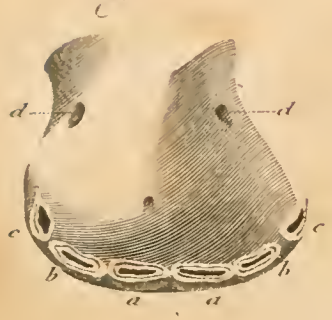


Fig. 3.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Ad. Cull. & Print. Mall. Sculptor fecit.

Fig. 9.

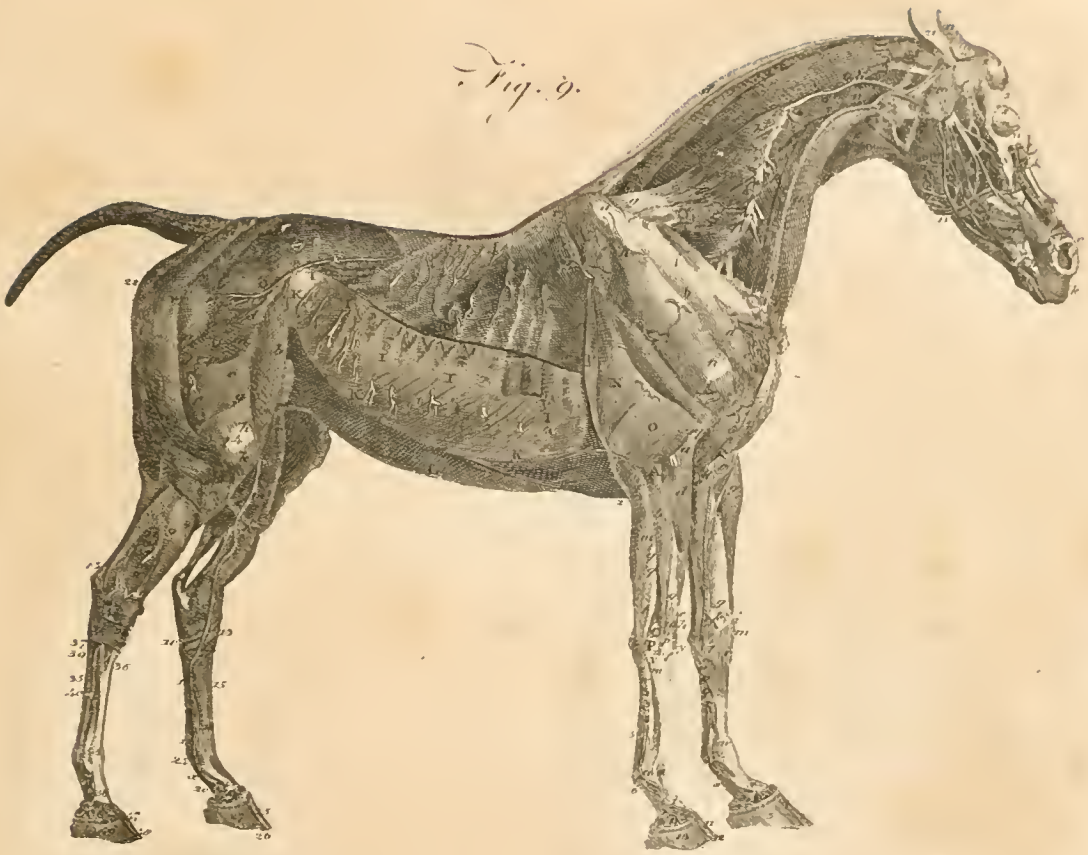
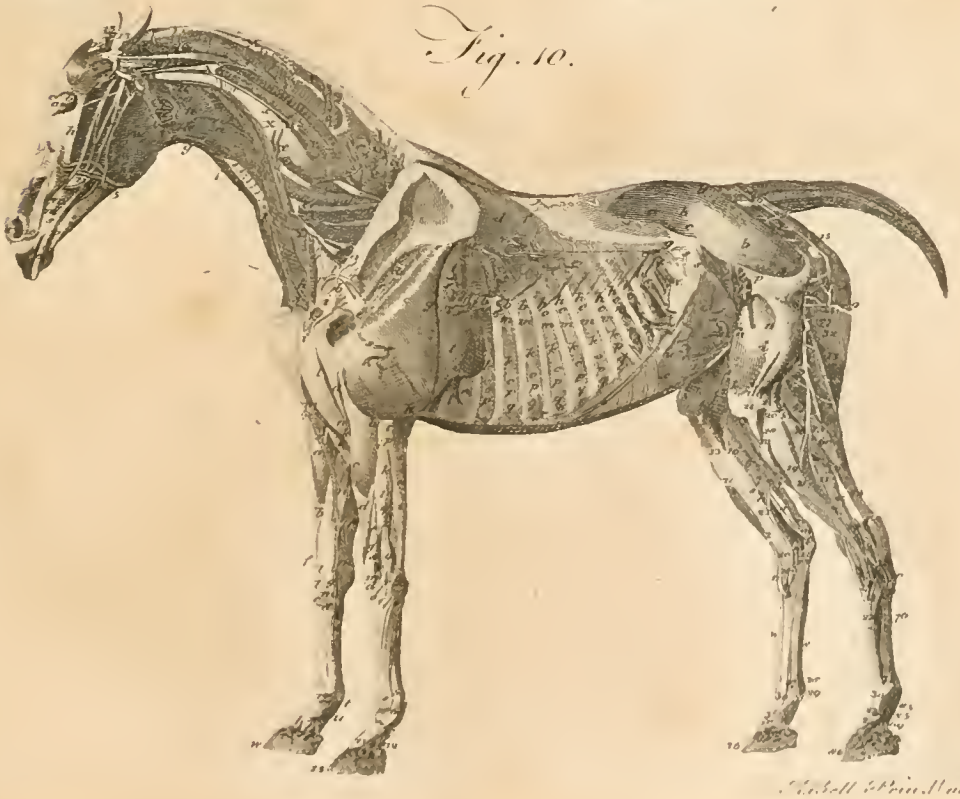


Fig. 10.



Tuthill & Pain Mad.r Sculptor fecit

Fig. 11.

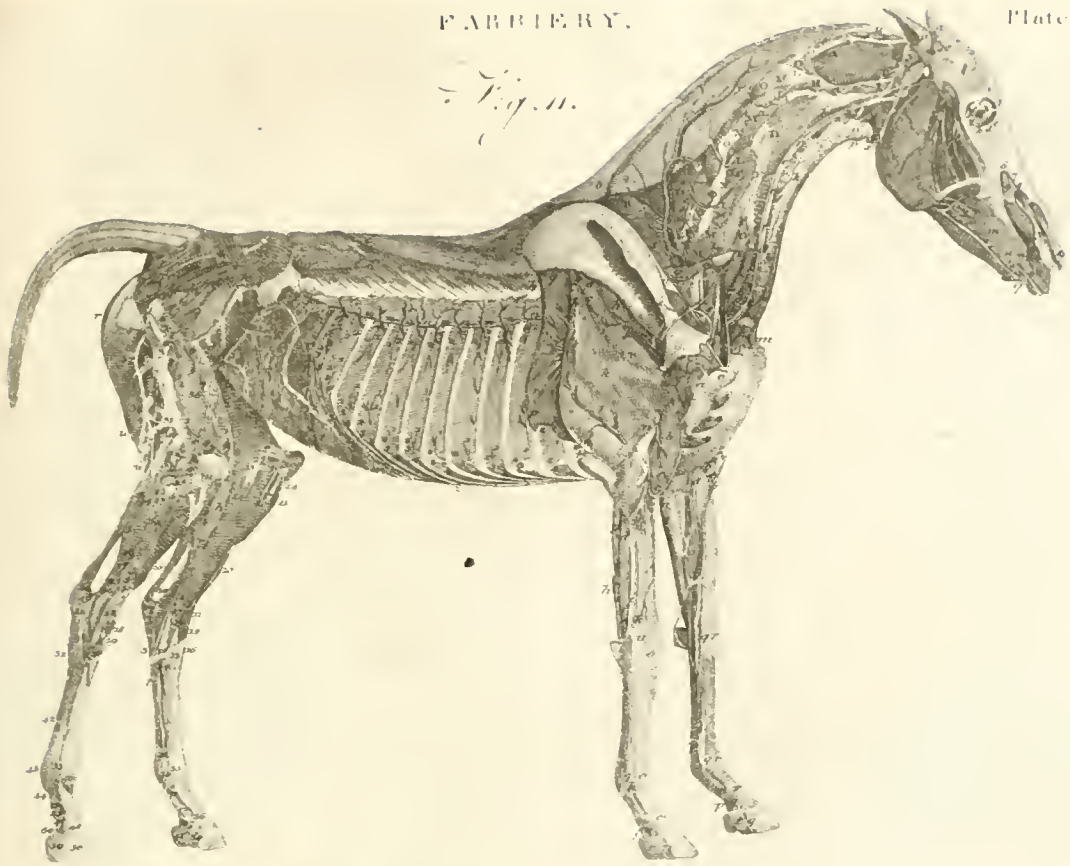
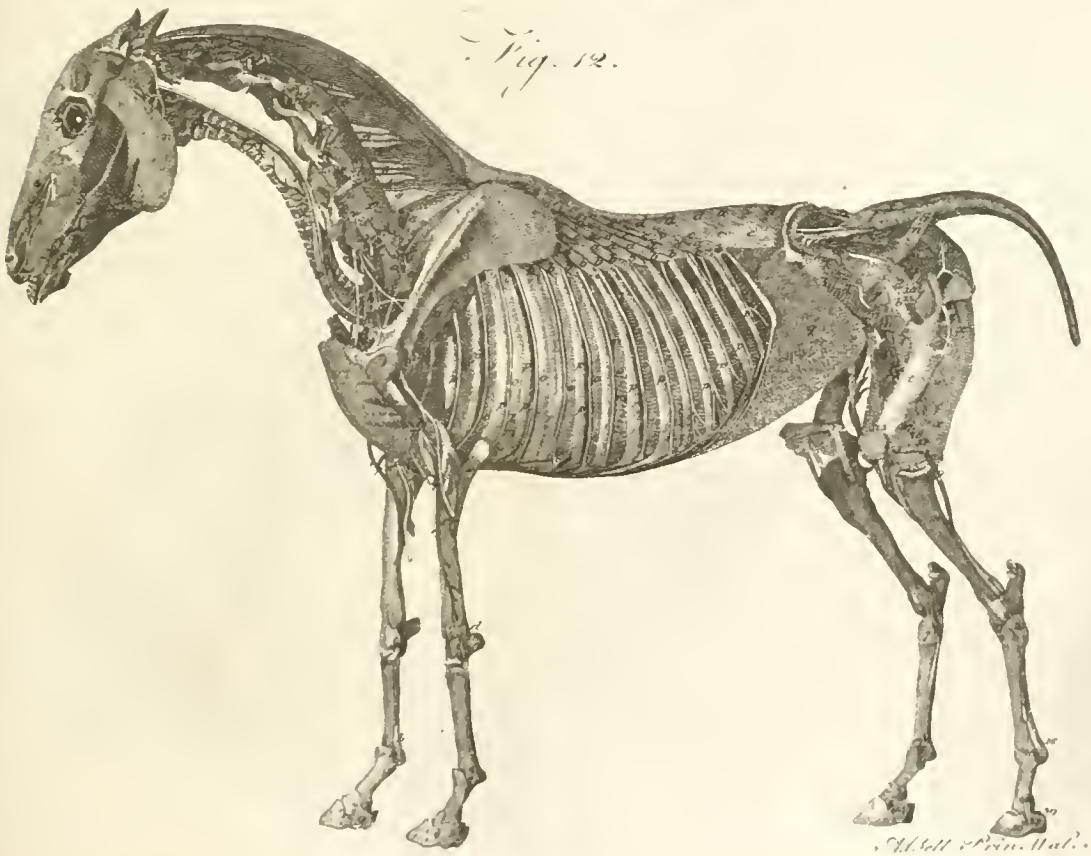


Fig. 12.



Ad. Cell. et Pern. Hal.ª Sculptor. fecit.

Fig. 13.

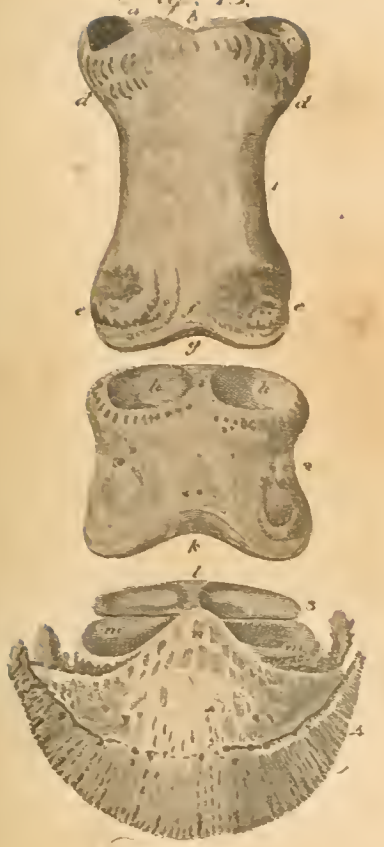


Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

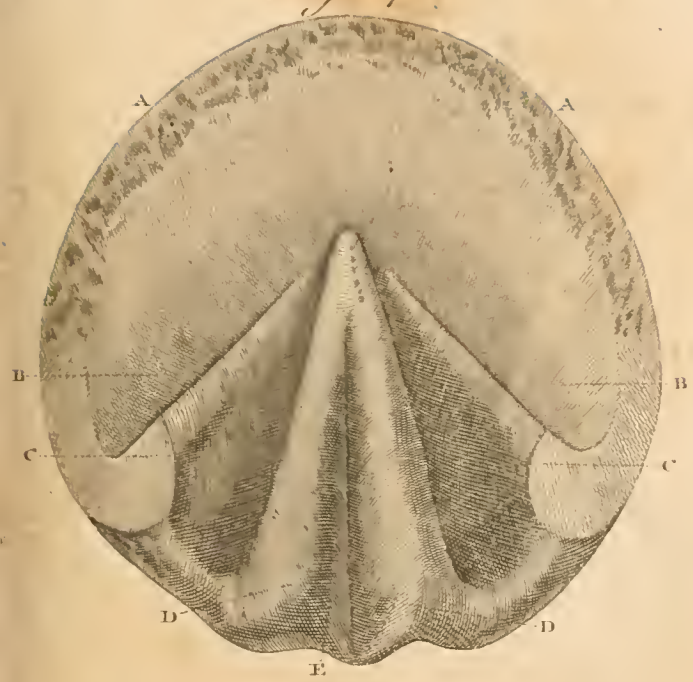


Fig. 18.

Fig. 19.

Fig. 20.

Diſeaſes. hiſtory of every contagious and endemic diſorder. We have, therefore, no reaſon to be ſurpriſed, that ſheep and animals are ſo immediately affected by paſturing in moiſt places, where theſe effluvia are copiouſly produced in hot weather. Other cauſes operate ſlowly, and require ſuch a long-continued application, that I do not think the rot can be induced by them, though I am of opinion, that by occaſioning general weakneſs, they make the conſtitution more ſuſceptible, and lay it more open to morbid impreſſions. In the human body, we know that fatigue, cold, faſting, and other debilitating cauſes, are efficacious auxiliaries, although of themſelves they are totally inadequate to produce any contagious diſorder. They, therefore, ſeem to contribute equally, and in the ſame manner, to facilitate the operations of marſh miaſmata, upon the human body and other animals *."

* *Harriſon on the Rot*, p. 31.

It is ſaid, that for a ſhort time after contracting the *rot*, ſheep feed more heartily than uſual; and for this reaſon, butchers and graziers, when they wiſh to fatten ſheep ſpeedily for the market, not unfrequently turn them into a rotting paſture.

The prevention of the *rot* will be eaſily ſuggeſted by attending to the facts and obſervations that have juſt been given, as it conſiſts in avoiding the cauſes that ſeem to produce it, and avoiding or correcting the ſoil where it is found moſt readily to take place. "It is confidently aſſerted, that decoctions of bitter herbs, with ſalt, have frequently preſerved ſheep from the *rot*. Salt is ſuppoſed to conſtitute a part of Fleet's celebrated noſtrum; and we know that bitters are deſervedly recommended to prevent intermittents, the dyſentery and other diſorders, which originate from exhalations. Diſeaſes.

"In Oxfordſhire, Dr Lower has frequently known ſix or ſeven ſpoonfuls of ſtrong brine, and ſtale urine, with foot ſteeped in it, to be given with great ſucceſs. This is done at ſpring and fall of the year, when the dew is counted the moſt dangerous. This courſe of phyſic is continued eight or ten days, or till the ſheep eat their meat heartily; and if they were taken in time, there ſeldom died any in a whole flock. For the ſame purpoſe, Ellis recommends the following medicine in his practical huſbandry.

"Take a peck or better of malt, and maſh it as though you would brew it into ale or beer, and make eleven or twelve gallons of liquor; then boil in it a quantity of ſhepherds purſe, comfrey, ſage, plantain, penny-royal, wormwood, and bloodwort; add yeaſt, and afterwards ſalt, to the mixture; then turn the liquor into a veſſel. After April comes in, give ſeven or eight ſpoonfuls to every ſheep, once in the week, if the weather be wet; and if dry, not ſo often *."

* *Harriſon on the Rot*, p. 41.

ERRATA.—N° 84. We have inadvertently hinted that Mr Feron's work on farriery has neither index nor table of contents. It has no table of contents, but it has an index.
N° 93. For 1803, read 1805.
N° 518. For *Trot*, read *Fret*.

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FAR

Farthing.

FARTHING, a ſmall Engliſh copper coin, amounting to one-fourth of a penny. It was anciently called *fourthing*, as being the fourth of the integer or penny.

Farthing of Gold, a coin uſed in ancient times, containing in value the fourth part of a noble, or 20d. ſilver. It is mentioned in the ſtat. 9 Hen. V. cap. 7. where it is enacted, that there ſhall be good and juſt weight of the noble, half-noble, and farthing of gold.

Farthing of Land ſeems to differ from *Farding-deal*. For in a ſurvey-book of the manor of Weſt-Hapton in Devonſhire, there is an entry thus: A. B. holds ſix farthings of land at 12l. per annum. So that the farthing of land muſt have been a conſiderable quantity, far more than a rood.

FAS

Faſces.

FASCES, in Roman antiquity, axes tied up together with rods or ſtaves, and borne before the Roman magiſtrates as a badge of their office and authority.

According to Florus, the uſe of the faſces was introduced by the elder Tarquin, the fifth king of Rome; and were then the mark of the ſovereign dignity. In after times they were borne before the conſuls, but by turns only, each his day; they had each of them 12, borne by as many lictors. Theſe faſces conſiſted of branches,

Faſcets || Faſcination.

branches of elm; having in the middle a ſecuris or axe, the head of which ſtood out beyond the reſt. Publicola took the axe out of the faſces, as Plutarch aſſures us, to remove from the people all occaſion of terror. After the conſuls, the pretors aſſumed the faſces. In the government of the decemvirs, it was the practice at firſt for only one of them to have the faſces. Afterwards each of them had twelve after the manner of the kings.

When the magiſtrates who by right had the axes carried before them, had a mind to ſhow ſome deference to the people, or ſome perſon of ſingular merit, they either ſent away the lictors, or commanded them to lower the faſces before them, which was called *ſubmittere faſces*. Many inſtances of this occur in Roman hiſtory.

FASCETS, in the art of making glaſs, are the irons thruſt into the mouths of bottles, in order to convey them to the annealing tower.

FASCIA, in antiquity, a thin faſh which the Roman women wrapped round their bodies, next to the ſkin, in order to make them ſlender. Something of this ſort ſeems alſo to have been in uſe amongſt the Grecian ladies, if we can depend upon the repreſentation given by Terence, Eun. act. ii. ſc. 4.

Haud ſimilis eſt virginum noſtrarum, quas matres ſtudent
Demiſſis humeris eſſe—vincto corpore, ut graciles fiant.

FASCIA, in *Architecture*, ſignifies any flat member having a conſiderable breadth and but a ſmal projecture, as the band of an architrave, larmier, &c. In brick buildings, the juttings out of the brick beyond the windows in the ſeveral ſtories except the higheſt are called *facias* or *faciæ*.

FASCIA Lata, in *Anatomy*, a muſcle of the leg, called alſo *ſemi-membranoſus*. See ANATOMY, *Table of the Muſcles*.

FASCIÆ, in *Aſtronomy*, the belts ſeen on the diſk of the ſuperior planets, Mars, Jupiter, and Saturn.—See ASTRONOMY, *paſſim*.

FASCIALIS, in *Anatomy*, one of the muſcles of the thigh, called *ſartorius*. See ANATOMY, *Table of the Muſcles*.

FASCINATION (from the Greek βασκαινειν, to *faſcinate* or *bewitch*), a ſort of witchcraft ſuppoſed to operate either by the eye or the tongue.

Ancient writers diſtinguiſh two ſorts of faſcination, one performed by looking, or the efficacy of the eye. Such is that ſpoken of by Virgil in his third eclogue:

Neſcio quis teneros oculus mihi faſcinat *agnos.*

The ſecond by words, and eſpecially by malignant praiſes. Such is that mentioned by the ſame poet in his ſeventh eclogue:

Aut, ſi ultra placitum laudârit, baccare frontem
Cingite, ne vati noceat mala lingua futuro.

Horace alludes to both kinds in his firſt book of epiſtles:

Non iſtic obliquo oculo mea commoda quiſquam
Limat, non odio obſcuro, morſuque venenat.

FASCINATION of ſerpents, a faculty which theſe animals are ſuppoſed to poſſeſs of attracting birds from the air, and making them their prey. See OPHIOLOGY *Index*. Faſcines || Faſt.

FASCINES, in *Fortification*, faggots of ſmall wood, of about a foot diameter, and ſix feet long, bound in the middle, and at both ends. They are uſed in raiſing batteries, making chandeliers, in filling up the moat to facilitate the paſſage to the wall, in binding the ramparts where the earth is bad; and in making parapets of trenches to ſcreen the men. Some of them are dipped in melted pitch or tar; and, being ſet on fire, ſerve to burn the enemy's lodgments or other works.

In corrupt Latin *faſcenina*, *faſcennia*, and *faſcinata*, &c. are uſed to ſignify the pales, faſcines, &c. uſed to encloſe ancient caſtles, &c.

FASCIOLA, the FLUKE or GOURD WORM, a genus belonging to the order of vermes inteſtina. See HELMINTHOLOGY *Index*.

FASHION-PIECES, in the ſea language, the aftmoſt or hindmoſt timbers of a ſhip, which terminate the breadth, and form the ſhape of the ſtern. They are united to the ſtern-poſt, and to the extremity of the wing-tranſom, by a rabbit, and a number of ſtrong nails or ſpikes driven from without.

FAST, in general, denotes the abſtinence from food, (ſee FASTING); but is more particularly uſed for ſuch abſtinence on a religious account.

Religious faſting has been practiſed by moſt nations from the remoteſt antiquity. Some divines even pretend its origin was in the earthly paradiſe, where our firſt parents were forbidden to eat of the tree of knowledge. But though this ſeems carrying the matter too far, it is certain that the Jewiſh church has obſerved faſts ever ſince its firſt inſtitution. Nor were the neighbouring heathens, viz. the Egyptians, Phœnicians, and Aſſyrians, without their faſts. The Egyptians, according to Herodotus, ſacrificed a cow to Iſis, after having prepared themſelves by faſting and prayer; a cuſtom which he likewiſe aſcribes to the women of Cyrene. Porphyry affirms, that the Egyptians, before their ſtated ſacrifices, always faſted a great many days, ſometimes for ſix weeks; and that the leaſt behoved to be for ſeven days: during all which time the prieſts and devotees not only abſtained from fleſh, fiſh, wine, and oil; but even from bread, and ſome kinds of pulſe. Theſe auſterities were communicated by them to the Greeks, who obſerved their faſts much in the ſame manner. The Athenians had the Eleuſinian and Theſmophorian faſts, the obſervation of which was very rigorous, eſpecially among the women, who ſpent one whole day ſitting on the ground in a mournful dreſs, without taking any nouriſhment. In the iſland of Crete, the prieſts of Jupiter were obliged to abſtain all their lives from fiſh, fleſh, and baked meats. Apuleius informs us, that whoever had a mind to be initiated in the myſteries of Cybele were obliged to prepare themſelves by faſting ten days; and, in ſhort, all the pagan deities, whether male or female, required this duty of thoſe that deſired to be initiated into their myſteries, of their prieſts and prieſteſſes that gave the oracles, and of thoſe who came to conſult them.

Among the heathens faſting was alſo practiſed before ſome of their military enterpriſes. Ariſtotle informs us, that the Lacedemonians having reſolved to ſuccour a city of the allies, ordained a faſt throughout the

Faſt. the whole extent of their dominions, without excepting even the domeſtic animals: and this they did for two ends; one to ſpare proviſions in favour of the beſieged; the other to draw down the bleſſing of heaven upon their enterpriſe. The inhabitants of Tarentum, when beſieged by the Romans, demanded ſuccours from their neighbours of Rhegium, who immediately commanded a faſt throughout their whole territories. Their enterpriſe having had good ſucceſs by their throwing a ſupply of proviſions into the town, the Romans were obliged to raiſe the ſiege; and the Tarentines, in memory of this deliverance, inſtituted a perpetual faſt.

Faſting has always been reckoned a particular duty among philoſophers and religious people, ſome of whom have carried their abſtinence to an incredible length. At Rome it was practiſed by kings and emperors themſelves. Numa Pompilius, Julius Cæſar, Auguſtus, Veſpaſian, and others, we are told, had their ſtated faſt days: and Julian the Apoſtate was ſo exact in this obſervance as to outdo the prieſts themſelves, and even the moſt rigid philoſophers. The Pythagoreans kept a continual lent; but with this difference, that they believed the uſe of fiſh to be equally unlawful with that of fleſh. Beſides their conſtant temperance, they alſo frequently faſted rigidly for a very long time. In this reſpect, however, they were all outdone by their maſter Pythagoras, who continued his faſts for no leſs than 40 days together. Even Apollonius Tyaneus, one of his moſt famous diſciples, could never come up to him in the length of his faſts, though they greatly exceeded thoſe of the ordinary Pythagoreans. The Gymnoſophiſts, or Brahmans of the eaſt, are alſo very remarkable for their ſevere faſtings; and the Chineſe, according to Father le Comte, have alſo their ſtated faſts, with forms of prayer for preſerving them from barrenneſs, inundations, earthquakes, &c. The Mahometans too, who poſſeſs ſo large a part of Aſia, are very remarkable for the ſtrict obſervance of their faſts; and the exactneſs of their derviſes in this reſpect is extraordinary.

Faſting was often uſed by the heathens for ſuperſtitious purpoſes; ſometimes to procure the interpretations of dreams; at others, to be an antidote againſt their pernicious conſequences. A piece of ſuperſtition prevails to this day among the Jews; who, though expreſsly forbidden to faſt on Sabbath-days, think themſelves at liberty to diſpenſe with this duty when they happen to have frightful and unlucky dreams the night preceding, that threatened them with great misfortunes. On theſe occaſions they obſerve a formal faſt the whole day; and at night the patient, having invited three of his friends, addreſſes himſelf to them ſeven times in a very ſolemn manner, ſaying, "May the dream I have had prove a lucky one!" And his friends anſwer as many times, "Amen, may it be lucky, and God make it ſo!" After which, in order to encourage him, they conclude the ceremony with theſe words of Eccleſiaſtes, "Go eat thy bread with joy;" and then ſet themſelves down to table. They have alſo added ſeveral faſts not commanded in the law of Moſes, particularly three, in memory of ſore diſtreſſes their nation has ſuffered at different times. The abſtinence of the ancient Jews commonly laſted 27 or 28 hours at a time; beginning before ſunſet, and not ending till ſome hours after ſunſet next day. On theſe days they were obliged to wear white robes in token of grief and repentance; to cover themſelves with ſackcloth, or their worſt clothes; to lie on aſhes; to ſprinkle them on their head, &c. Some ſpent the whole night and day following in the temple or ſynagogue, in prayers and other devotions, barefooted, with a ſcourge in their hands, of which they ſometimes made a good uſe in order to raiſe their zeal. Laſtly, in order to complete their abſtinence, at night they were to eat nothing but a little bread dipped in water, with ſome ſalt for ſeaſoning; except they choſe to add to their repaſt ſome bitter herbs and pulſe.

Faſt
|
Faſti.

The ancients, both Jews and Pagans, had alſo their faſts for purifying the body, particularly the prieſts and ſuch as were any way employed at the altars; for when nocturnal diſorders happened to theſe, it was unlawful for them to approach all the next day, which they were bound to employ in purifying themſelves. On this account, at great feſtivals, where their miniſtry could not be diſpenſed with, it was uſual for them, on the eve thereof, not only to faſt, but alſo to abſtain from ſleep, for the greater certainty. For this purpoſe the high prieſt had under officers to wake him, if overtaken with ſleep; againſt which other preſervatives were alſo made uſe of.

FASTERMANS, or FASTING-MEN, q. d. *homines habentes*, was uſed in our ancient cuſtoms for men in repute and ſubſtance; or rather for pledges, ſureties, or bondſmen, who, according to the Saxon polity, were faſt bound to anſwer for one another's peaceable behaviour.

FASTI, in Roman antiquity, the kalendar wherein were expreſſed the ſeveral days of the year, with their feaſts, games, and other ceremonies.

There were two ſorts of faſti, the greater and leſs: the former being diſtinguiſhed by the appellation *faſti magiſtrales*, and the latter by that of *faſti kalendares*.

1. The *faſti kalendares*, which were properly and primarily called *faſti*, are defined by Feſtus Pompeius to be books containing a deſcription of the whole year: i. e. ephemerides, or diaries, diſtinguiſhing the ſeveral kinds of days, *feſti*, *profeſti*; *faſti*, *nefaſti*, &c. The author of theſe was Numa, who committed the care and direction of the faſti to the pontifex maximus, whom the people uſed to conſult on every occaſion. This cuſtom held till the year of Rome 450, when C. Flavius, ſecretary to the pontifices, expoſed in the forum a liſt of all the days on which it was lawful to work; which was ſo acceptable to the people, that they made him curule ædile.

Theſe leſſer faſti, or faſti kalendares, were of two kinds, *urbani* and *ruſtici*.

The *faſti urbani*, or faſti of the city, were thoſe which obtained or were obſerved in the city. Some will have them thus called, becauſe they were expoſed publicly in divers parts of the city; though by the various inſcriptions or gravings thereof on antique ſtones, one would imagine that private perſons had them likewiſe in their houſes. Ovid undertook to illuſtrate theſe faſti urbani, and comment on them, in his Libri Faſtorum,

Faſti, Faſting.

Faſtorum, whereof we have the firſt ſix books ſtill remaining; the laſt ſix, if ever they were written, being loſt.

In the *faſti ruſtici*, or country faſti, were expreſſed the ſeveral days, feaſts, &c. to be obſerved by the country people: for as theſe were taken up in tilling the ground, fewer feaſts, ſacrifices, ceremonies, and holidays, were enjoined them than the inhabitants of cities; and they had alſo ſome peculiar ones not obſerved at Rome. Theſe ruſtic faſti contained little more than the ceremonies of the kalends, nones, and ides; the fairs, ſigns of the zodiac, increaſe and decreaſe of the days, the tutelary gods of each month, and certain directions for rural works to be performed each month.

2. In the greater faſti, or *faſti magiſtrales*, were expreſſed the ſeveral feaſts, with every thing relating to the gods, religion, and the magiſtrates; the emperors, their birth-days, offices, days conſecrated to them, and feaſts and ceremonies eſtabliſhed in their honour, or for their proſperity, &c. With a number of ſuch circumſtances did flattery at length ſwell the faſti; when they became denominated *Magni*, to diſtinguiſh them from the bare kalendar, or faſti kalendares.

Fasti was alſo a chronicle or regiſter of time, wherein the ſeveral years were denoted by the reſpective conſuls, with the principal events that happened during their conſulates; theſe were called alſo *faſti conſulares*, or *conſular faſti*.

Fasti, or *Dies Faſti*, alſo denoted court days. The word *faſti faſtorum*, is formed of the verb *fari*, "to ſpeak," becauſe during thoſe days the courts were opened, cauſes might be heard, and the prætor was allowed *fari*, to pronounce the three words, *do*, *dico*, *addico*: The other days wherein this was prohibited were called *nefaſti*: thus Ovid,

Ille nefaſtus erit, per quem tria verba ſilentur:
Faſtus erit, per quem lege licebit agi.

Theſe *dies faſti* were noted in the kalendar by the letter *F*: but obſerve, that there were ſome days *ex parte faſti*, partly *faſti*, partly *nefaſti*; i. e. juſtice might be diſtributed at certain times of the day, and not at others. Theſe days were called *interciſi*, and were marked in the kalendar thus; *F. P. faſtos primo*, where juſtice might be demanded during the firſt part of that day.

Faſting.

FASTING, the abſtaining from food. See Fast.

Many wonderful ſtories have been told of extraordidary faſting; great numbers of which undoubtedly muſt be falſe. Others, however, we have on very good authority, of which ſome are mentioned under the article Abstinence. Another we have in the

Fasting Woman. A full account of this very uncommon caſe is given in the Phil. Tranſ. Vol. LXVII. Part I. the ſubſtance of which follows: The woman, whoſe name was *Janet M'Leod*, an inhabitant of the pariſh of Kincardine in Roſsſhire, continued healthy till ſhe was 15 years of age, when ſhe had a pretty ſevere epileptic fit; after this ſhe had an interval of health for four years, and then another epileptic fit which continued a whole day and a night. A few days afterwards ſhe was ſeized with a fever, which continued with violence ſeveral weeks, and from which ſhe did not perfectly recover for ſome months. At this time ſhe loſt the uſe of her eyelids; ſo that ſhe was under a neceſſity of keeping them open with the fingers of one hand, whenever ſhe wanted to look about her. In other reſpects ſhe continued in pretty good health; only ſhe never had any appearance of menſes, but periodically ſpit up blood in pretty large quantities, and at the ſame time it flowed from the noſe. This diſcharge continued ſeveral years; but at laſt it ceaſed: and ſoon after ſhe had a third epileptic fit, and after that a fever from which ſhe recovered very ſlowly. Six weeks after the criſis, ſhe ſtole out of the houſe unknown to her parents, who were buſied in their harveſt work, and bound the ſheaves of a ridge before ſhe was obſerved. In the evening ſhe took to her bed, complaining much of her *heart* (moſt probably her *ſtomach*, according to the phraſeology of that country) and her head. From that time ſhe never roſe for five years, but was occaſionally lifted out of bed. She ſeldom ſpoke a word, and took ſo little food that it ſeemed ſcarce ſufficient to ſupport a ſucking infant. Even this ſmall quantity was taken by compulſion; and at laſt, about Whitſunday 1763, ſhe totally refuſed every kind of food or drink. Her jaw now became ſo faſt locked, that it was with the greateſt difficulty her father was able to open her teeth a little, in order to admit a ſmall quantity of gruel or whey; but of this ſo much generally run out at the corners of her mouth, that they could not be ſenſible any had been ſwallowed. About this time they got ſome water from a noted medicinal ſpring in Brae-Mar, ſome of which they attempted to make her ſwallow, but without effect. They continued their trials, however, for three mornings; rubbing her throat with the water, which run out at the corners of her mouth. On the third morning during the operation, ſhe cried out, "Give me more water;" and ſwallowed with eaſe all that remained in the bottle. She ſpoke no more intelligibly for a year; though ſhe continued to mutter ſome words, which her parents only underſtood, for 14 days. She continued to reject all kinds of food and drink till June 1765. At this time her ſiſter thought, by ſome ſigns ſhe made, that ſhe wanted her jaws opened; and this being done, not without violence, ſhe called intelligibly for a drink, and drank with eaſe about an Engliſh pint of water. Her father then aſked her why ſhe would not make ſome ſigns when ſhe wanted a drink? to which ſhe anſwered, why ſhould ſhe when ſhe had no deſire. It was now ſuppoſed that ſhe had regained the faculty of ſpeech; and her jaws were kept open for about three weeks by means of a wedge. But in four or five days ſhe became totally ſilent, and the wedge was removed becauſe it made her lips ſore. She ſtill, however, continued ſenſible; and when her eyelids were opened, knew every body, as could be gueſſed from the ſigns ſhe made.

By continuing their attempts to force open her jaws, two of the under foreteeth were driven out; and of this opening her parents endeavoured to avail themſelves by putting ſome thin nouriſhing drink into her mouth; but without effect, as it always returned by the corners. Sometimes they thought of thruſting a little dough of oatmeal through this gap of the teeth, which ſhe would retain a few ſeconds, and then return with ſomething like a ſtraining to vomit, without one particle

Faſting. ticle going down. Nor were the family ſenſible of any thing like ſwallowing for four years, excepting the ſmall draught of Brae-Mar water and the Engliſh pint of common water. For the laſt three years ſhe had not any evacuation by ſtool or urine, except that once or twice a-week ſhe paſſed a few drops of urine, about as much, to uſe the expreſſion of her parents, as would wet the ſurface of a halfpenny. In this ſituation ſhe was viſited by Dr Mackenzie, who communicated the account of her caſe to the Royal Society. He found her not at all emaciated; her knees were bent, and the hamſtrings tight, ſo that her heels almoſt touched her buttocks. She ſlept much, and was very quiet: but when awake, kept a conſtant whimpering like a newborn weakly infant. She never could remain a moment on her back, but always fell to one ſide or another; and her chin was clapped cloſe to her breaſt, nor could it by any force be moved backwards.

The doctor paid his firſt viſit in the month of October; and five years afterwards, viz. in October 1772, was induced to pay her a ſecond viſit, by hearing that ſhe was recovering, and had begun to eat and drink. The account given him was moſt extraordinary. Her parents one day returning from their country labours (having left their daughter fixed to her bed as uſual), were greatly ſurpriſed to find her ſitting upon her hams, on the ſide of the houſe oppoſite to her bed-place, ſpinning with her mother's diſtaff. All the food ſhe took at that time was only to crumble a little oat or barley cake in the palm of her hand, as if to feed a chicken. She put little crumbs of this into the gap of her teeth; rolled them about for ſome time in her mouth; and then ſucked out of the palm of her hand a little water, whey, or milk; and this only once or twice a-day, and even that by compulſion. She never attempted to ſpeak; her jaws were faſt locked, and her eyes ſhut. On opening her eyelids, the balls were found to be turned up under the edge of the os frontis; her countenance was ghaſtly, her complexion pale, and her whole perſon emaciated. She ſeemed ſenſible, and tractable in every thing except in taking food. This ſhe did with the utmoſt reluctance, and even cried before ſhe yielded. The great change of her looks Dr Mackenzie attributed to her ſpinning flax on the diſtaff, which exhauſted too much of the ſaliva; and therefore he recommended to her parents to confine her totally to the ſpinning of wool. In 1775, ſhe was viſited again, and found to be greatly improved in her looks as well as ſtrength; her food was alſo conſiderably increaſed in quantity; though even then ſhe did not take more than would be ſufficient to ſuſtain an infant of two years of age.

The following remarkable inſtances of animals being able to live long without food, are related by Sir William Hamilton in his account of the late earthquakes in Italy (*Phil. Tranſ.* vol. lxxiii). "At Soriano (ſays he), two fattened hogs that had remained buried under a heap of ruins, were taken out alive the 42d day; they were lean and weak, but ſoon recovered." Again, "At Meſſina two mules belonging to the duke de Belviſo remained under a heap of ruins, one of them 22 days, and the other 23 days; they would not eat for ſome days, but drank water plentifully, and are now recovered. There are numberleſs inſtances of dogs remaining many days in the ſame ſituation; and a hen belonging to the Britiſh vice-conſul at Meſſina, that had been cloſely ſhut up under the ruins of his houſe, was taken out the 22d day, and is now recovered; it did not eat for ſome days, but drank freely; it was emaciated, and ſhowed little ſigns of life at firſt. From theſe inſtances, and thoſe related before of the hogs at Soriano, and ſeveral others of the ſame kind that have been related to me, but which being leſs remarkable I omit, one may conclude, that long faſting is always attended with great thirſt and total loſs of appetite." Faſting. Faſtolf.

An inſtance of a ſimilar kind, not leſs remarkable than either of the two preceding, we find in the Gentleman's Magazine for January 1785, communicated by a correſpondent, as follows: "During the heavy ſnow which fell in the night of the 7th of January 1776, a parcel of ſheep belonging to Mr John Wolley, of Matlock, in Derbyſhire, which were paſtured on that part of the Eaſt Moor that lies within the manor of Matlock, were covered with the drifted ſnow: in the courſe of a day or two all the ſheep that were covered with the ſnow were found again, except two, which were conſequently given up as loſt; but on the 14th of February following (ſome time after the break of the ſnow in the valleys, and 38 days after the fall), as a ſervant was walking over a large parcel of drifted ſnow which remained on the declivity of a hill, a dog he had with him diſcovered one of the two ſheep that had been loſt, by winding (or ſcenting) it through a ſmall aperture which the breath of the ſheep had made in the ſnow; the ſervant thereupon dug away the ſnow, and releaſed the captive from its priſon; it immediately ran to a neighbouring ſpring, at which it drank for a conſiderable time, and afterwards rejoined its old companions as though no ſuch accident had befallen it. On inſpecting the place where it was found, it appeared to have ſtood between two large ſtones which lay parallel with each other at about two feet and a half diſtance, and probably were the means of protecting it from the great weight of the ſnow, which, in that place lay ſeveral yards thick: from the number of ſtones around it, it did not appear that the ſheep had been able to pick up any food during its confinement. Soon afterwards its owner removed it to ſome low lands; but as it had nearly loſt its appetite, it was fed with bread and milk for ſome time: in about a fortnight after its enlargement it loſt its ſight and wool; but in a few weeks afterwards they both returned again, and in the courſe of the following ſummer it was quite recovered. The remaining ſheep was found dead about a week after the diſcovery of the other."

In the ſame publication † is recorded the death of one Caleb Elliot, a viſionary enthuſiaſt, who meant to have faſted 40 days, and actually ſurvived 16 without food, having obſtinately refuſed ſuſtenance of every kind. † Suppl. for 1789. Obituary, p. 1211.

FASTOLF, Sir John, a valiant and renowned Engliſh officer, a knight banneret and of the garter, who ſerved in France under Henry IV. V. and VI. was deſcended from an ancient family in Norfolk, and was born about the year 1377. He was as much diſtinguiſhed for his virtue at home as for his valour abroad; and became no leſs amiable in his private, than he had been admirable in his public character. He died in 1457, upwards of 80 years of age, as we learn

Fat. learn from his noted cotemporary William Caxton the firſt Engliſh printer. By an unaccountable miſtake it has been aſſerted, that Shakeſpeare's Falſtaff was drawn to ridicule this great man; and this has made judicious biographers more ſtudious to preſerve his reputation.

FAT, an oily concrete ſubſtance, depoſited in different parts of animal bodies. See ANATOMY *Index*.

Strong exerciſe, preternatural heat, an acrimonious ſtate of the juices, and other like cauſes, by which the oily parts of the blood are attenuated, reſolved, or evacuated, prevent the generation of fat; labours of the mind alſo have this effect, as well as labour or intemperature of the body. Hence reſt and plentiful food are ſufficient to fatten brutes; but with men it is often otherwiſe. It is ſurpriſing how ſoon ſome birds grow fat; ortolans, it is ſaid, in 24 hours, and larks ſtill ſooner.

Fats may be divided, from their conſiſtence, into three kinds: (1.) The ſoft and thin, which grow perfectly liquid in a very ſmall heat; (2.) The thick and conſiſtent, which liquefy leſs readily; and, (3.) The hard and firm, which require a ſtill ſtronger heat to melt them. The firſt is called *Pinguedo;* the ſecond, *Axungia;* and the third, *Adeps*, as taken from the animal; and *Sebum*, or *Sevum*, when freed from the ſkins, &c. This uſe of the names, however, is not conſtant, ſome employing them differently.

A great number of fats have been kept in the ſhops, for making ointments, plaſters, and other medicinal compoſitions; as hog's lard, the fat of the boar, the fox, the hare, dog, wild cat, Alpine mouſe, beaver; that of hens, ducks, geeſe, ſtorks; of the whale, pike, ſerpents, viper, &c. as alſo human fat.—In regard to all theſe kinds of ſubſtances, however, much depends upon the manner of purifying or trying, and of keeping them.

To obtain fat pure, it muſt be cut into pieces, and cleaned from the interpoſed membranes and veſſels. It muſt then be cleanſed from its gelatinous matter by waſhing with water, till the water comes from it colourleſs and inſipid; it is afterwards to be melted with a moderate heat in a proper veſſel with a little water; and it is to be kept thus melted till the water be entirely evaporated, which is known by the diſcontinuance of the boiling, which is cauſed by the water only, and which laſts till not a drop of it remains; it is afterwards to be put into an earthen pot, where it fixes; then it is exceedingly white, ſufficiently pure for the purpoſes of pharmacy or chemical examination.

Fat thus purified has very little taſte, and a weak, but peculiar ſmell. For its analyſis and chemical properties, ſee CHEMISTRY *Index*.

One of the chief uſes of fat probably is, to receive into its compoſition, to blunt and correct, a great part of the acids of the aliments, and which are more than are requiſite to the compoſition of the nutritive juice, or which nature could not otherwiſe expel. This is certain, that the greater the quantity of aliments taken by healthy animals, above what is neceſſary for their nouriſhment and reproduction, the fatter they become. Hence animals which are caſtrated, which are not much exerciſed, or which are come to an age when the loſs and production of the ſeminal fluid is leſs, and which at the ſame time conſume much ſucculent aliment, generally become fatter, and ſometimes exceedingly ſo. Fat, Fata Morgana.

Although fat be very different from truly animalized ſubſtances, and appears not eaſily convertible into nutritive juices, it being generally difficult of digeſtion, and apt to become rancid, as butter does in the ſtomachs of many perſons; yet in certain caſes it ſerves to the nouriſhment and reparation of the body. Animals certainly become lean, and live upon their fat, when they have too little food, and when they have diſeaſes which prevent digeſtion and the production of the nutritive juice; and in theſe caſes the fatter animals hold out longer than the leaner. The fat appears to be then abſorbed by the veſſels deſigned for this uſe, and to be transformed into nutritive juice.

FAT, in the ſea language, ſignifies the ſame with broad. Thus a ſhip is ſaid to have a fat quarter, if the truſſing in or tuck of her quarter be deep.

FAT likewiſe denotes an uncertain meaſure of capacity. Thus a fat of iſinglaſs contains from $3\frac{1}{2}$ hundred weight to 4 hundred weight; a fat of unbound books, half a maund or four bales; of wire, from 20 to 25 hundred weight; and of yarn, from 220 to 221 bundles.

FAT, or VAT, is uſed alſo for ſeveral utenſils: as, 1. A great wooden veſſel, employed for meaſuring of malt, and containing a quarter or eight buſhels. 2. A large brewing veſſel, uſed by brewers to run their wort in. 3. A leaden pan or veſſel for the making of ſalt at Droitwich.

FATA MORGANA; a very ſingular phenomenon, mentioned by different philoſophical writers and travellers, particularly by Brydone and Swinburne. They inform us that it is ſeen in the ſtraits of Meſſina, and ſometimes denominated the *caſtles of the Fairy Morgana*. The accounts of this phenomenon differ conſiderably from each other, and travellers are not unanimous as to the cauſes which are neceſſary for its production. It would perhaps be difficult to determine how far the imagination of thoſe who have ſpoken of it may be conſidered capable of producing aſtoniſhment, yet the actual exiſtence of ſuch a phenomenon admits of no diſpute.

The firſt chapter of Minaſi, in his Diſſertation on the Fata Morgana, ſpeaks of this phenomenon in the following manner. When the riſing ſun ſhines from that point whence its incident ray forms an angle of 45° on the ſea of Reggio, and the bright ſurface of the water in the bay is not diſturbed either by the wind or the current, the ſpectator being placed on an eminence of the city, with his back to the ſun and his face to the ſea; on a ſudden there appear in the water, as in a catoptric theatre, various multiplied objects, that is to ſay, numberleſs ſeries of pilaſters, arches, caſtles well delineated, regular columns, lofty towers, ſuperb palaces, with balconies and windows, extended alleys of trees, delightful plains with herbs and flocks, armies of men on foot and horſeback, and many other ſtrange images, in their natural colours and proper actions, paſſing rapidly in ſucceſſion along the ſurface of the ſea during the whole of the ſhort period of time while the above-mentioned cauſes remain.

"But if, in addition to the circumſtances before deſcribed, the atmoſphere be highly impregnated with vapour and denſe exhalations, not previouſly diſperſed by the action of the wind or waves, or rarefied by the ſun, it

Fata Morgana.

it then happens that in this vapour, as in a curtain extended along the channel to the height of about 30 palms, and nearly down to the sea, the observer will behold the scene of the same objects not only reflected from the surface of the sea, but likewise in the air, though not so distinct or well defined as the former objects from the sea.

"If the air be slightly hazy and opake, and at the same time dewy and adapted to form the iris, then the above-mentioned objects will appear only at the surface of the sea, as in the first case, but all vividly coloured, or fringed with red, green, blue, and other prismatic colours."

From this account of Minasi it appears, that there are three different species of Fata Morgana; the first appearing at the surface of the sea, denominated the *Marine Morgana*; the second in the air, called the *Aërial Morgana*, and the third only at the surface of the sea, or *Morgana* fringed with prismatic colours. The same ingenious author attempted to trace the etymology of the word *Morgana*, which he thinks is derived from μωρος, *tristis*, and γανυω, *lætitiâ afficio*. This splendid sight affects all descriptions of men with such joy, that they run towards the sea, exclaiming *Morgana, Morgana!* This etymology of Minasi may seem at first view to be a contradiction in terms; but it will appear most natural, when we consider the joy which the Morgana inspires, and the corresponding sorrow or dejection which must be felt when it vanishes away. Our author informs us, that he beheld this magnificent appearance three times, and would rather behold it again than the "most superb theatrical exhibition in the world."

In his physical and astronomical remarks on this phenomenon, he observes that the sea in the straits of Messina exhibits the appearance of a large inclined speculum; that, in the alternate current or tide which flows and returns in the straits for six hours each way, and is constantly attended by an opposite current along shore to the medium distance of about half a league, there are many eddies and irregularities at the time of the change of its direction; and that the Morgana usually appears at this period. He ascribes the effects produced by it to the supposed inclination of the surface of the sea, and its subdivision into different planes by the contrary eddies. The effects produced in the air he considers as the result of saline and other effluvia suspended in the air. These appearances are produced by a calm sea, and one or more strata of superincumbent air differing in refractive, and consequently in reflective power, rather than from any considerable change in the surface of the water, with the laws of which we are much better acquainted than with those of the atmosphere.

To the above account we shall add the following, given by M. Houel, whose judgment and veracity render his authority highly respectable. "In fine summer days, when the weather is calm, there rises above the great current a vapour, which acquires a certain density, so as to form in the atmosphere horizontal prisms, whose sides are disposed in such a manner, that when they come to their proper degree of perfection, they reflect and represent successively, for some time (like a moveable mirror), the objects on the coast or in the adjacent country. They exhibit by turns the city and suburbs of Messina, trees, animals, men, and mountains. They are certainly beautiful aerial moving pictures. There are sometimes two or three prisms, equally perfect; and they continue in this state eight or ten minutes. After this, some shining inequalities are observed upon the surface of the prism, which render confused to the eye the objects which had been before so accurately delineated, and the picture vanishes. The vapour forms other combinations, and is dispersed in air. Different accounts have been given of this singular appearance; which for my part I attribute to a bitumen that issues from certain rocks at the bottom of the sea, and which is often seen to cover a part of its surface in the strait of Messina. The subtile parts of the bitumen being attenuated, combined, and exhaled with the aqueous globules that are raised by the air, and formed into bodies of vapour, give to this condensed vapour more consistence; and contribute, by their smooth and polished particles, to the formation of a kind of aerial crystal, which receives the light, reflects it to the eye, and transmits to it all the luminous points which colour the objects exhibited in this phenomenon, and render them visible."

Father.

FATE (*fatum*), denotes an inevitable necessity depending upon a superior cause. The word is formed *à fando*, "from speaking:" and primarily implies the same with *effatum*, viz. a word or decree pronounced by God; or a fixed sentence whereby the Deity has prescribed the order of things, and alloted to every person what shall befal him.

The Greeks called it αμαρμενη, as it were a chain or necessary series of things indissolubly linked together. It is also used to express a certain unavoidable designation of things, by which all agents, both necessary and voluntary, are swayed and directed to their ends. See NECESSITY.

In this last sense, fate is distinguished into, 1. Astrological fate, arising from the influence and position of the heavenly bodies; which (it was supposed) gave laws both to the elements and mixed bodies, and to the wills of men. 2. Stoical fate, defined by Cicero an order or series of causes, wherein, cause being linked to cause, each produces another, and thus all things flow from one prime cause. To this fate the Stoics subject even the gods.

Fate is divided by later authors into physical and divine. Physical fate is an order and series of natural causes appropriated to their effects. By this fate it is that fire warms, bodies communicate motion to each other, &c. and the effects of it are all the events and phenomena of nature. 2. Divine fate is what is more usually called *Providence*. See PROVIDENCE.

FATES, in mythology. See PARCÆ.

FATHEMITES, FATEMITES, or FATHIMITES, the descendants of Mahomet by Fathema, or Fatima, his daughter. They never enjoyed the caliphate of Mecca or Bagdad, but reigned in Barbary and Egypt. See the history of these countries.

FATHER, a term of relation denoting a person who hath begot a child. See PARENT and CHILD.

By the laws of Romulus, a father had an unlimited power over his children. Amongst the Lacedemonians, as we learn from Aristotle's Politics, the father of three children was excused from the duty of mounting guard for the security of the city; and a father of four children was exempted from every public burden. The Poppæan law, amongst the Romans, granted many valuable privileges to the fathers of three children;

Father || Fauna.

dren; amongſt which one was, that he ſhould be excuſed from civil offices, and that the mother ſhould have liberty, in her father's lifetime, to make a will, and manage her eſtate without the authority of tutors.

Natural FATHER, is he who has illegitimate children. See BASTARD; and LAW *Index*.

Adoptive FATHER, is he who takes the children of ſome other, and acknowledges them as his own. See ADOPTION.

Putative FATHER, is he who is only the reputed or ſuppoſed father. Joſeph was putative father of our Saviour.

Father-in-law, is a perſon married to a woman who has children by a former huſband, &c. to which children he is ſaid to be a father-in-law.

FATHER is alſo uſed in theology for the Firſt Perſon in the Trinity.

FATHER is alſo uſed in a figurative ſenſe on divers moral and ſpiritual occaſions. Thus, it is applied to the patriarchs; as we ſay Adam was the father of all mankind, Abraham the father of the faithful, &c.

FATHER, in church hiſtory, is applied to ancient authors who have preſerved in their writings the traditions of the church. Thus St Chryſoſtom, St Baſil, &c. are called *Greek fathers*, and St Auguſtine and St Ambroſe *Latin fathers*. No author who wrote later than the 12th century is dignified with the title of *Father*.

FATHER, is alſo a title of honour given to prelates and dignitaries of the church, to the ſuperiors of convents, to congregations of eccleſiaſtics, and to perſons venerable for their age or quality. Thus we ſay, the right reverend father in God, the father general of the Benedictines, the fathers of the council of Nice, father of his country, &c.

FATHERLASHER, a ſpecies of fiſhes belonging to the genus cottus. See COTTUS, ICHTHYOLOGY *Index*.

FATHOM, a long meaſure containing ſix feet, uſed chiefly at ſea for meaſuring the length of cables and cordage.

FATNESS. See CORPULENCY.—It is obſerved, that for one fat perſon in France or Spain, there are a hundred in England and Holland. This is ſuppoſed to be from the uſe of new malt liquors, more than from the difference of climates or degrees of perſpiration. Indolence may cauſe fatneſs in ſome few conſtitutions; but, in general, thoſe who are diſpoſed to this habit will be fat in ſpite of every endeavour to the contrary, but that of deſtroying health.

FATUARII, in antiquity, were perſons who, appearing inſpired, foretold things to come. The word is formed of *Fatua*, wife of the god Faunus, who was ſuppoſed to inſpire women with the knowledge of futurity, as Faunus himſelf did the men.—Fatua had her name from *fari*, q. d. *vaticinari*, "to propheſy."

FAVISSÆ, in antiquity, were, according to Feſtus and Gellius, ciſterns to keep water in: but the faviſſæ in the Capitol at Rome were dry ciſterns or ſubterraneous cellars, where they laid up the old ſtatues, broken veſſels, and other things uſed in the temple. Theſe were much the ſame with what, in ſome of the modern churches, are called the *archives* and *treaſury*.

FAUNA, a deity among the Romans. She was daughter of Picus, and was originally called *Marica*. Her marriage with Faunus procured her the name of *Fauna*, and her knowledge of futurity that of *Fatua* and *Fatidica*. It is ſaid that ſhe never ſaw a man after her marriage with Faunus, and that her uncommon chaſtity occaſioned her being ranked among the gods afer death. She is the ſame, according to ſome, as *Bona Mater*.

Faunalia || Fawkes.

FAUNALIA, in antiquity, Roman feaſts celebrated in honour of the god Faunus, who was the ſame among the Romans with the *Pan* of the Greeks.

The Faunalia were held on the day of the nones of December; i. e. on the fifth day of that month. The principal ſacrifice was a roe-buck; or rather, according to Horace, a kid, attended with libations of wine and burning of incenſe. It was properly a country feſtival, being performed in the fields and villages with peculiar joy and devotion. Horace gives us a very gay deſcription thereof in the 18th ode of his third book:

> ——*Tener pleno cadit hædus anno:*
> *Larga nec deſunt Veneris ſodali*
> *Vina crateræ: vetus ara multo*
> *Fumat odore.*

Struvius in his Roman kalendar marks the feaſt of Faunus on the day of the ides of February, which is the 30th day of that month; and the Faunalia he places on the fifth of the ides of December, or the 9th of that month: and in chap. ix. he ſhews, that there really were two Faunalia; the one in February, mentioned by Ovid, Faſt. lib. iv. ver. 246, the other on the 9th of December, mentioned by Horace in the place juſt cited.

FAUNS (FAUNI), among the ancients, were a ſpecies of demi-gods inhabiting the foreſts; called alſo *Sylvans* (*Sylvani*), and little differing from the Satyrs. They delighted more particularly in vineyards; and they generally appear as attendants of Bacchus, in the repreſentations of Bacchanal feaſts and proceſſions.—They were repreſented as half men, half goats, having the horns, ears, feet, and tail of a goat, a very flat noſe, and the reſt human. Though the Fauns were held for demi-gods, yet they were ſuppoſed to die after a long life. Arnobius ſhows that their father or chief, Faunus himſelf, only lived 120 years.

FAUNUS, in fabulous hiſtory, a ſon of Picus who reigned in Italy about 1300 years before the Auguſtan age. His bravery, as well as wiſdom, have given riſe to the tradition that he was ſon of Mars. His great popularity, and his fondneſs for agriculture, made his ſubjects revere him as one of their country deities after death. He was repreſented with all the equipage of the ſatyrs, and was conſulted to give oracles.

FAVONIUS, among the Romans, the wind which blew directly from the weſt.

FAVORINUS, an ancient orator and philoſopher of Gaul, who flouriſhed under the emperor Adrian, and taught with high reputation both at Athens and Rome. Many works are attributed to him; among the reſt, a Greek miſcellaneous hiſtory often quoted by Diogenes Laertius.

FAUSTUS. See FUST.

FAWKES, FRANCIS, an ingenious poet, had his ſchool education at Leeds; from whence he was tranſplanted to Jeſus College, Cambridge, where he took the degrees in arts. Entering early into holy orders, he

Fawn || Fealty.

he ſettled firſt at Bramham in Yorkſhire, near the elegant ſeat of that name (Mr Lane's), which he celebrated in verſe in 1745, in a 4to pamphlet anonymous. His firſt poetical publications were, Gawen Douglas's Deſcription of May and Winter modernized. Removing afterwards to the curacy of Croydon in Surry, he recommended himſelf to the notice of Archbiſhop Herring, then reſident there on account of his health, to whom, beſides other pieces, he addreſſed an ode on his recovery in 1754, printed in Mr Dodſley's collection. In conſequence, his grace collated him in 1755 to the vicarage of Orpington with St Mary Gray in Kent; and Mr Fawkes lamented his patron's death in 1757 in a pathetic elegy ſtyled *Aurelius*, firſt printed with his grace's ſeven ſermons, in 1763. He married about the ſame time Miſs Purrier of Leeds. In April 1774, by the late Dr Plumtree's favour, he exchanged his vicarage for the rectory of Hayes. He was alſo one of the chaplains to the princeſs dowager of Wales. He publiſhed a volume of poems by ſubſcription in 8vo, 1761; the Poetical Kalendar 1763; and Poetical Magazine 1764, in conjunction with Mr Woty; Partridge Shooting, an eclogue, to the honourable Cha. Yorke, 1767, 4to; and a Family Bible, with notes, in 4to, a compilation. But his great ſtrength lay in tranſlation, in which, ſince Pope, few have equalled him. Witneſs his fragments of Menander (in his Poems); his works of Anacreon, Sappho, Bion, Moſchus, and Muſæus, 12mo, 1760; his Idylliums of Theocritus, by ſubſcription, 8vo, 1767; and his Argonautics of Apollonius Rhodius, by ſubſcription alſo (a poſthumous publication, completed by the Reverend Mr Meen of Emanuel College, Cambridge), 8vo, 1780. He died Auguſt 26. 1777.

FAWN, among ſportſmen, a buck or doe of the firſt year; or the young one of the buck's breed in its firſt year.

FE, Fo, or *Foki*, the name of the chief god of the Chineſe, whom they adore as the ſovereign of heaven. They repreſent him ſhining all in light, with his hands hid under his robes, to ſhow that his power does all things inviſibly. He has at his right hand the famous Confucius, and at his left Lanza or Lanca, chief of the ſecond ſect of their religion.

FEAL, a provincial term for ſod or turf.

Feal-Dikes, a cheap ſort of fence common in Scotland; built with feal or ſod dug up by the ſpade from the ſurface of graſs ground, conſiſting of the upper mould rendered tough and coherent by the matted roots of the graſs thickly interwoven with it. If only a very thin bit of the upper ſurface is pared off with a paring ſpade, the pieces are called *divots*. Theſe being of a firmer conſiſtence, are more durable when built into dikes than feal, but much more expenſive alſo.

FEALTY, in *Law*, an oath taken on the admittance of any tenant, to be true to the lord of whom he holds his land: by this oath the tenant holds in the freeſt manner, on account that all who have fee hold *per fidem et fiduciam*, that is, by fealty at the leaſt.

This fealty, at the firſt creation of it, bound the tenant to fidelity, the breach of which was the loſs of his fee. It has been divided into general and ſpecial: general, that which is to be performed by every ſubject to his prince; and ſpecial, required only of ſuch as, in reſpect of their fee, are tied by oath to their lords. To all manner of tenures, except tenancy at will, and frank-almoign, fealty is incident, though it chiefly belongs to copyhold eſtates held in fee and for life. The form of this oath, by ſtat. 17 Edw. II. is to run as follows: "I A. B. will be to you my lord D. true and faithful, and bear to you faith for the lands and tenements which I hold of you; and I will truly do and perform the cuſtoms and ſervices that I ought to do to you. So help me God."

Fear, Fealt.

FEAR, one of the paſſions of the human mind: (ſee PASSION). It is defined, an apprehenſion of impending evil, attended with a deſire of avoiding it.

Fear in the extreme is called *fright* or *terror*. See FRIGHT.

FEAR, in Scripture, is uſed in various ſenſes.

The *fear of God* is either filial or ſervile. The filial fear is a holy affection or gracious habit in the ſoul, whereby it is inclined to obey all God's commandments, and to hate and avoid evil. Slaviſh or ſervile fear is the conſequence of guilt; it is a judicial impreſſion from the ſad thoughts of the provoked majeſty of heaven; it is an alarm within that diſturbs the reſt of a ſinner. Though this fear be in wicked men, yet it often proves preparative to faith and repentance.

Fear is likewiſe uſed for the *object* of fear. Thus it is ſaid, "the *fear* of Iſaac," to deſcribe the God whom Iſaac feared; (Gen. xxxi. 24.), and in Prov. i. 26. "I will mock when your *fear* cometh;" that is, the calamity you feared. God ſays, that he will ſend his *fear* before his people; that is, a dread wrought by him, in order to terrify and deſtroy the inhabitants of Canaan.

FEAR (*Metus*, *Pavor*, or *Timor*), was deified by the Pagans. Tullus Hoſtilius brought the worſhip of this deity to Rome. The Ephori of Sparta erected a temple to Fear, near their tribunal, to ſtrike an awe into thoſe who approached it. Fear was likewiſe worſhipped at Corinth. The poets did not forget this imaginary deity. Virgil places her in the entrance of hell, in company with diſeaſes, old age, &c. *Æn.* vi. 273. Ovid places her in the retinue of Tiſiphone one of the furies, *Met.* iv. 483.

FEAST, or FESTIVAL, in a religious ſenſe, is a ceremony of feaſting and thankſgiving. The word is formed of the Latin *feſtum*, which ſome derive *à feriari* "to keep holiday;" others from the Greek ἑστιάω, "I feaſt or entertain," of ἑστία, "hearth, fire."

Feaſts, and the ceremonies thereof, have made great part of the religion of almoſt all nations and ſects; witneſs thoſe of the Greeks, Romans, Hebrews, Chriſtians, and Mahometans.

The firſt feaſts among the Greeks were celebrated in ſolemn aſſemblies of the whole nation, on occaſion of their games, as the Olympic, the Pythian, the Iſthmian, and Nemæan: in proceſs of time they had many others, the principal of which are enumerated in the courſe of this work.

The Romans alſo had abundance of ſtated feaſts in honour of their deities and heroes; ſuch were the Saturnalia, Cerealia, Lupercalia, Liberalia, Neptunalia, Conſualia, Portumnalia, Vulcanalia, Palilia, Divalia, &c. See SATURNALIA, &c.

They had alſo feaſts inſtituted occaſionally; as Carmentalia,

Feaſt. mentalia, Quirinalia, Terminalia, Floralia, Compitalia, Lemuria, Vernalia, beſide other moveable and occaſional ones: as to give thanks to the gods for benefits received; to implore their aſſiſtance, or to appeaſe their wrath, &c. as the Paganalia, Feralia, Bacchanalia, Ambarvalia, Amburbalia, Suovetaurilia, and divers others, particularly denominated *feriæ*; as Sementinæ, Latinæ, &c. See each of theſe feaſts, and *feriæ* in its proper place. The feaſts were divided into days of ſacrifice, and days of banqueting and feaſting; days of games, and days of reſt or *feriæ*.

There being but little hiſtory written, or at leaſt publiſhed in thoſe days, one end of feaſts was to keep up the remembrance of paſt occurrences.

The principal feaſts of the Jews were the feaſt of trumpets, that of the expiation, of tabernacles, of the dedication, of the paſſover, of pentecoſt, and that of purification. See EXPIATION, &c.

The modern Jews have other feaſts marked in their kalendar, of modern inſtitution. The Mahometans, beſides their weekly feaſt or Sabbath, which is kept on Friday, have two ſolemn feaſts, the firſt of which is called the *Feaſt of Victims*, and celebrated on the tenth day of the laſt month of their year; and the ſecond called *Bairam*. The Chineſe have two ſolemn feaſts in the year, in the memory of Confucius, beſides others of leſs note on the other days of the year.

Feaſts among us are either *immoveable* or *moveable*.

Immoveable Feaſts are thoſe conſtantly celebrated on the ſame day of the year; the principal of theſe are Chriſtmas day or the Nativity, the Circumciſion, Epiphany, Candlemas or the Purification, Lady Day or the Annunciation, called alſo the *Incarnation* and *Conception*, All Saints and All Souls; beſides the days of the ſeveral Apoſtles, St Thomas, St Paul, &c. which with us are feaſts, though not *feriæ*. See each feaſt under its proper article.

Moveable Feaſts are thoſe which are not confined to the ſame day of the year. Of theſe the principal is Eaſter, which gives law to all the reſt, all of them following, and keeping their proper diſtances from it; ſuch are Palm-Sunday, Good-Friday, Aſh-Wedneſday, Sexageſima, Aſcenſion Day, Pentecoſt, and Trinity-Sunday. See EASTER, SEXAGESIMA, PENTECOST, TRINITY, &c.

The four feaſts which the Engliſh laws take ſpecial notice of are, the Annunciation of the bleſſed Virgin Mary or Lady Day, the 25th of March; the nativity of St John the Baptiſt, held on the 24th of June; the Feaſt of St Michael the Archangel, on the 29th of September; and that of St Thomas the Apoſtle, on the 21ſt of December: on which quarterly days rent on leaſes is uſually reſerved to be paid (5 and 6 Edw. VI. cap. 3. 3 Jac. I. cap. 1. 12 Car. II. cap. 30.)

Beſides theſe feaſts which are *general*, and enjoined by the church, there are others *local* and *occaſional*, enjoined by the magiſtrate, or voluntarily ſet on foot by the people; ſuch are the days of thankſgiving for deliver from wars, plagues, &c. Such alſo are the vigils or wakes in commemoration of the dedications of particular churches. See VIGIL, &c.

The prodigious increaſe of feaſt days in the Chriſtian church commenced towards the cloſe of the fourth century, and was occaſioned by the diſcovery that was then made of the remains of martyrs and other holy men, for the commemoration of whom they were eſtabliſhed. Theſe, inſtead of being ſet apart for pious exerciſes, were abuſed in indolence, voluptuouſneſs, and criminal practices. Many of them were inſtituted on a pagan model, and perverted to ſimilar purpoſes. Feaſt.

Feast of Death, or *Feaſt of Souls*, a ſolemn religious ceremony in uſe among the ſavages of America; ſome of whom thus teſtify their reſpect for the deceaſed every eight years; and others, as the Hurons and Iroquois, every ten years.

The day of this ceremony is appointed by public order; and nothing is omitted, that it may be celebrated with the utmoſt pomp and magnificence. The neighbouring tribes are invited to be preſent, and to join in the ſolemnity. At this time all who have died ſince the laſt ſolemn occaſion are taken out of their graves; thoſe who have been interred at the greateſt diſtance from the villages are diligently ſought for, and brought to this great rendezvous of carcaſes.

It is not difficult to conceive the horror of this general diſinterment; but it cannot be deſcribed in a more lively manner than it is done by Lafitau, to whom we are indebted for the moſt authentic account of thoſe nations.

"Without queſtion (ſays he), the opening of theſe tombs diſplays one of the moſt ſtriking ſcenes that can be conceived; this humbling portrait of human miſery, in ſo many images of death, wherein ſhe ſeems to take a pleaſure to paint herſelf in a thouſand various ſhapes of horror, in the ſeveral carcaſes, according to the degree in which corruption has prevailed over them, or the manner in which it has attacked them. Some appear dry and withered; others have a ſort of parchment upon their bones; ſome look as if they were baked and ſmoked, without any appearance of rottenneſs; ſome are juſt turning towards the point of putrefaction; whilſt others are all ſwarming with worms, and drowned in corruption. I know not which ought to ſtrike us moſt, the horror of ſo ſhocking a ſight, or the tender piety and affection of theſe poor people toward their departed friends: for nothing deſerves our admiration more than that eager diligence and attention with which they diſcharge this melancholy duty of their tenderneſs; gathering up careſully even the ſmalleſt bones, handling the carcaſes, diſguſtful as they are, with every thing loathſome, cleanſing them from the worms, and carrying them upon their ſhoulders through tireſome journeys of ſeveral days, without being diſcouraged from the offenſiveneſs of the ſmell, and without ſuffering any other emotions to ariſe than thoſe of regret, for having loſt perſons who were ſo dear to them in their lives, and ſo lamented in their death.

"They bring them into their cottages, where they prepare a feaſt in honour of the dead; during which their great actions are celebrated, and all the tender intercourſes which took place between them and their friends are pioufly called to mind. The ſtrangers, who have come ſometimes many hundred miles to be preſent on the occaſion, join in the tender condolence; and the women, by frightful ſhrieks, demonſtrate that they are pierced with the ſharpeſt ſorrow. Then the dead bodies are carried from the cabins for the general re-interment. A great pit is dug in the ground, and thither.

Feaſt. thither, at a certain time, each perſon attended by his family and friends, marches in ſolemn ſilence, bearing the dead body of a ſon, a father, or a brother. When they are all convened, the dead bodies, or the duſt of thoſe which were quite corrupted, are depoſited in the pit: then the torrent of grief breaks out anew. Whatever they poſſeſs moſt valuable is interred with the dead. The ſtrangers are not wanting in their generoſity, and confer thoſe preſents which they have brought along with them for the purpoſe. Then all preſent go down into the pit, and every one takes a little of the earth, which they afterwards preſerve with the moſt religious care. The bodies, ranged in order, are covered with entire new furs, and over theſe with bark, on which they throw ſtones, wood, and earth. Then taking their laſt farewell, they return each to his own cabin.

"We have mentioned, that in this ceremony the ſavages offer, as preſents to the dead, whatever they value moſt highly. This cuſtom, which is univerſal among them, ariſes from a rude notion of the immortality of the ſoul. They believe this doctrine moſt firmly, and it is the principal tenet of their religion. When the ſoul is ſeparated from the body of their friends, they conceive that it ſtill continues to hover around it, and require and take delight in the ſame things with which it formerly was pleaſed. After a certain time, however, it forſakes this dreary manſion, and departs far weſtward into the land of ſpirits. They have even gone ſo far as to make a diſtinction between the inhabitants of the other world; ſome, they imagine, particularly thoſe who in their lifetime have been fortunate in war, poſſeſs a high degree of happineſs, have a place for hunting and fiſhing, which never fails, and enjoy all ſenſual delights, without labouring hard in order to procure them. The ſouls of thoſe, on the contrary, who happen to be conquered or ſlain in war, are extremely miſerable after death."

FEAST is alſo uſed for a banquet, or a ſumptuous meal, without any immediate view to religion.

The uſe of the word, in this ſenſe, ariſes hence; that a part of the ceremony of many of the ancient feſtivals, both thoſe of the heathens and agapæ of the Chriſtians, was good eating; though Mr Huet chooſes to derive the word from *feſtinare*, which, in an ancient Latin verſion of Origen's Comment on Matthew, ſignifies "to feaſt:" *Ut veniens illuc Jeſus feſtinet cum diſcipulis ſuis.*

Social or civil feaſts were alſo expreſſed by the words *convivium* and *compotatio* or *concanatio*. Cicero ſays, that in the Roman tongue, the word *convivium*, which means "people aſſembled at table," is more ſignificant than the Greek word *compotatio* or *concanatio*: the Roman, ſays he, expreſſes the conjunction of body and mind which ought to take place at an entertainment; the Greek denotes what relates to the body alone.

As food is neceſſary to our exiſtence, it makes a bond of aſſociation among mankind. People at a feaſt, ſays one of the ancients, ſeem to form but one body, one ſoul. All nations, whether ſavage or civilized, have regarded the pleaſure of the table as the occaſion of the moſt agreeable ſociety. This ſpecies of enjoyment (abſtracting from its ſuſceptibility of abuſe) makes but one family of all that it brings together. It levels the diſtinctions introduced by policy or prejudice, and diſpoſes men to regard one another as brethren. It is here that people feel the equality eſtabliſhed by nature; here they forget the evils of life; they extinguiſh their hatred, and make their enmities ceaſe. For this reaſon Ariſtotle conſiders as a breach of the ſocial principle that cuſtom of the Egyptians of eating apart, and praiſes the convivial repaſts eſtabliſhed by Minos and Lycurgus. Feaſt.

The Perſians generally deliberated on buſineſs at table, but never determined or put their determinations in execution except in the morning before having eaten.

When the Germans, ſays Tacitus, wanted to reconcile enemies, to make alliances, to name chiefs, or to treat of war and peace, it was during the repaſt that they took counſel; a time in which the mind is moſt open to the impreſſions of ſimple truths, or moſt eaſily animated to great attempts. Theſe artleſs people during the conviviality of the feaſt ſpoke without diſguiſe. Next day they weighed the counſels of the former evening: they deliberated at a time when they were not diſpoſed to feign, and took their reſolution when they were leaſt liable to be deceived.

People of rank among the Rhodians, by a fundamental law of the ſtate, were obliged to dine daily with thoſe who had the management of affairs, in order to deliberate with them concerning ſuch things as were neceſſary or uſeful for the country; and on this account the principal miniſters of the kingdom were obliged to keep open table for all who could be of uſe to the ſtate.

Among the Romans, the place where they ſupped was generally the veſtibule, that a more retired part of the houſe might not encourage licentiouſneſs and diſorder. There were ſeveral laws that reſtricted their meals to thoſe veſtibules.

When luxury reigned in Rome, they had ſuperb halls for their entertainments. Lucullus had many, each of which bore the name of ſome deity; and this name was a mark which indicated to the ſervants the expence of the entertainment. The expence of a ſupper in Lucullus's hall of Apollo amounted to 50,000 drachmas.

The hall in which Nero feaſted, by the circular motion of its walls and ceiling, imitated the revolutions of the heavens, and repreſented the different ſeaſons of the year, changing at every courſe, and ſhowering down flowers and perfumes on the gueſts.

The Romans did not, as we do, uſe but one table at their feaſts; they had generally two; the firſt was for the ſervices of animal food, which was afterwards removed, and another introduced with fruits; at this laſt they ſung and poured out their libations. The Greeks and eaſtern nations had the ſame cuſtom, and even the Jews in their ſolemn feaſts and at ſacrifices.

The Romans, in the time of Nero, had tables made of citron wood brought from Mauritania; they were varniſhed with purple and gold, and were raiſed on feet of carved ivory. It is ſaid that they were more precious than gold. Dion Caſſius affirms, that Seneca had 500 of theſe, which he made uſe of one after another; and Tertullian tells us that Cicero had but one. The Romans choſe the king of the feaſt by a throw of the dice.

We

Feaſt. We learn from Herodotus, that the ancients had neither cups nor bowls, but that they drank out of little horns tipt with ſilver or gold.

Under the reign of Charles V. of France, the cuſtom of placing the lights upon the table was not yet introduced. A number of domeſtics held the candles in their hands during the whole time of the repaſt.

The Greeks and Romans kept a domeſtic for the purpoſe of reading during their meals and feaſts. Sometimes the chief of the family himſelf performed the office of reader; and hiſtory informs us, that the emperor Severus often read while his family ate. The time of reading was generally at ſupper; and gueſts were invited to a reading as they are now a-days to play cards.

The Greeks, in their flouriſhing times, did not profane, according to their own expreſſion, the *holineſs* of the table; but rather adorned it with ingenious and elegant converſation: they propoſed moral topics, of which Plutarch has preſerved a collection.

Ancient philoſophers remark, that heroes rarely aſſembled convivially without bringing affairs of conſequence into diſcourſe, or deliberating upon thoſe that regarded either preſent events or future contingencies.

The Scythians, while at meat, uſed to make the ſtrings of their bows reſound, leſt their warlike virtus might be enfeebled or loſt in this ſeaſon of pleaſur.

When Rome was corrupted with luxury, ſingers, dancers, muſicians, ſtage-players, and people that told pleaſant tales, were brought into the hall to amuſe the gueſts.

Plutarch informs us, that Cæſar, after his triumphs, treated the Roman people at 22,000 tables: and by calculation it would ſeem that there were at theſe tables upwards of 200,000 perſons.

At the end of the feaſt the Romans drunk out of a large cup as often as there were letters in the name of their miſtreſſes.

Feaſting ſeems to have been the chief delight of the Germans, Gauls, Britons, and all the other Celtic nations; in which they indulged themſelves to the utmoſt, as often as they had an opportunity. "Among theſe nations (ſays an author who had carefully ſtudied their manners) there is no public aſſembly, either for civil or religious purpoſes, duly held; no birthday, marriage, or funeral, properly celebrated; no treaty of peace or alliance rightly cemented, without a great feaſt." It was by frequent entertainments of this kind that the great men or chieftans gained the affections and rewarded the ſervices of their followers; and thoſe who made the greateſt feaſts were ſure to be moſt popular, and to have the greateſt retinue. Theſe feaſts (in which plenty was more regarded than elegance) laſted commonly ſeveral days, and the gueſts ſeldom retired until they had conſumed all the proviſions and exhauſted all the liquors. Athenæus deſcribes an entertainment that was given by Arcamnes, a very wealthy prince in Gaul, which continued a whole year without interruption, and at which all the people of Gaul, and even all ſtrangers who paſſed through that country, were made welcome. At theſe feaſts they ſometimes conſulted about the moſt important affairs of ſtate, and formed reſolutions relating to peace and war; imagining that men ſpoke their real ſentiments with the greateſt freedom, and were apt to form the boldeſt deſigns, when their ſpirits were exhilarated with the pleaſures of the table. The converſation at theſe entertainments very frequently turned on the great exploits which the gueſts themſelves or their anceſtors had performed in war; which ſometimes occaſioned quarrels and even bloodſhed. It was at a feaſt that the two illuſtrious Britiſh princes, Cairbar and Oſcar, quarrelled about their own bravery and that of their anceſtors, and fell by mutual wounds, (*Oſſian*, vol. ii. p. 8, &c.) Feaſt.

Pelloutier Hiſt Celt. l. ii. c. 12. p. 463.

As to the drink uſed at thoſe feaſts, particularly in Britain, it ſeems probable, that before the introduction of agriculture into the iſland, mead, or honey diluted with water, was the only ſtrong liquor known to its inhabitants, as it was to many other ancient nations in the ſame circumſtances. This continued to be a favourite beverage among the ancient Britons and their poſterity long after they had become acquainted with other liquors. The mead-maker was the eleventh perſon in dignity in the courts of the ancient princes of Wales, and took place of the phyſician. The following ancient law of that principality ſhows how much this liquor was eſteemed by the Britiſh princes.—"There are three things in the court which muſt be communicated to the king before they are made known to any other perſon: 1. Every ſentence of the judge; 2. Every new ſong; and, 3. Every caſk of mead." This was perhaps the liquor which is called by Oſſian the joy and ſtrength of ſhells, with which his heroes were ſo much delighted.—After the introduction of agriculture, ale or beer became the moſt general drink of all the Britiſh nations who practiſed that art, as it had long been of all the Celtic people on the continent (See ALE.) If the Phœnicians or Greeks imported any wine into Britain, it was only in very ſmall quantities; that moſt generous liquor being very little known in this iſland before it was conquered by the Romans. The drinking veſſels of the Gauls, Britons, and other Celtic nations, were, for the moſt part, made of the horns of oxen and other animals; but thoſe of the Caledonians conſiſted of large ſhells, which are ſtill uſed by ſome of their poſterity in the Highlands of Scotland.

The diſhes in which the meat was ſerved up were either of wood or earthen ware, or a kind of baſkets made of oſiers. Theſe laſt were moſt uſed by the Britons, as they very much excelled in the art of making them both for their own uſe and for exportation. The gueſts ſat in a circle upon the ground, with a little hay, graſs, or the ſkin of ſome animal under them. A low table or ſtool was ſet before each perſon, with the portion of meat allotted to him upon it. In this diſtribution, they never neglected to ſet the largeſt and beſt pieces before thoſe who were moſt diſtinguiſhed for their rank, their exploits, or their riches. Every gueſt took the meat ſet before him in his hands, and tearing it with his teeth, fed upon it in the beſt manner he could. If any one found difficulty in ſeparating any part of his meat with his hands and teeth, he made uſe of a large knife, that lay in a particular place for the benefit of the whole company. Servants, or young boys and girls, the children of the family, ſtood behind the gueſts, ready to help them to drink or any thing they wanted.

Feaſt.

As the ancient Britons greatly excelled and very much delighted in muſic, all their feaſts were accompanied with the joys of ſong, and the muſic of harps. In the words of Oſſian †, "whenever the feaſt of ſhells is prepared, the ſongs of bards ariſe. The voice of ſprightly mirth is heard. The trembling harps of joy are ſtrung. They ſing the battles of heroes, or the heaving breaſts of love." Some of the poems of that illuſtrious Britiſh bard appear to have been compoſed in order to be ſung by the hundred bards of Fingal ‡ at the feaſt of Selma. Many of the ſongs of the bards which were ſung and played at the feaſts of the ancient Britons, were of a grave and ſolemn ſtrain, celebrating the brave actions of the guells, or of the heroes of other times; but theſe were ſometimes intermixed with more ſprightly and cheerful airs, to which the youth of both ſexes danced, for the entertainment of the company.

† Vol. ii. p. 9. vol. i. p. 37.

‡ *Ibid.* vol. i. p. 87. 209.

It has been often obſerved by authors, that there is no nation in the world comes near the Engliſh in the magnificence of their feaſts. Thoſe made at our coronations, inſtalments, conſecrations, &c. tranſcend the belief of all foreigners; and yet it is doubted whether thoſe now in uſe are comparable to thoſe of our forefathers.

William the Conqueror, after he was peaceably ſettled on the throne of England, ſent agents into different countries, to collect the moſt admired and rare diſhes for his table; by which means, ſays John of Saliſbury, this iſland, which is naturally productive of plenty and variety of proviſions, was overflowed with every thing that could inflame a luxurious appetite. The ſame writer tells us, that he was preſent at an entertainment which laſted from three o'clock in the afternoon to midnight; at which delicacies were ſerved up, which had been brought from Conſtantinople, Babylon, Alexandria, Paleſtine, Tripoli, Syria, and Phœnicia. Theſe delicacies, we may preſume, were very expenſive. Thomas Becket, if we may believe his hiſtorian Fitz-Stephen, gave 5l. equivalent to 75l. at preſent, for one diſh of eels. The ſumptuous entertainments which the kings of England, and of other countries, gave to their nobles and prelates, at the feſtivals of Chriſtmas, Eaſter, and Whitſuntide, in which they ſpent a great part of their revenues, contributed very much to diffuſe a taſte for profuſe and expenſive banqueting. It was natural for a proud and wealthy baron to imitate in his own caſtle the entertainments he had ſeen in the palace of his prince. Many of the clergy too, both ſeculars and regulars, being very rich, kept excellent tables. The monks of St Swithins, at Wincheſter, made a formal complaint to Henry II. againſt their abbot, for taking away three of the 13 diſhes they uſed to have every day at dinner. The monks of Canterbury were ſtill more luxurious: for they had at leaſt 17 diſhes every day, beſides a deſſert; and theſe diſhes were dreſſed with ſpices and ſauces, which excited the appetite as well as pleaſed the taſte.

Great men had ſome kinds of proviſions at their tables that are not now to be found in Britain. When Henry II. entertained his own court, the great officers of his army, with all the kings and great men of Ireland, in Dublin, at the feaſt of Chriſtmas, A. D. 1171, the Iriſh princes and chieftans were quite aſtoniſhed at the profuſion and variety of proviſions which they beheld, and were with difficulty prevailed upon by Henry to eat the fleſh of cranes, a kind of food to which they had not been accuſtomed. In the remaining monuments of this period, we meet with the names of ſeveral diſhes, as dellegrout, maupigyrnun, karumpie, &c. the compoſition of which is now unknown. Feaſt.

The coronation feaſt of Edward III. coſt 2835l. 18s. 2d. equivalent to about 40,000l. of our money. At the inſtallation of Ralph abbot of St Auguſtine, Canterbury, A. D. 1309, 6000 gueſts were entertained with a dinner, conſiſting of 3000 diſhes, which coſt 287l. 5s. equal in efficacy to 4300l. in our times. "It would require a long treatiſe (ſays Matthew Paris) to deſcribe the aſtoniſhing ſplendour, magnificence, and feſtivity with which the nuptials of Richard earl of Cornwall, and Cincia daughter of Raimund earl of Provence, were celebrated at London, A. D. 1243. To give the reader ſome idea of it, in a few words, above 30,000 diſhes were ſerved up at the marriage dinner." The nuptials of Alexander III. of Scotland, and the princeſs Margaret of England, were ſolemnized at York, A. D. 1251, with ſtill greater pomp and profuſion. "If I attempted (ſays the ſame hiſtorian) to diſplay all the grandeur of this ſolemnity,—the numbers of the noble and illuſtrious gueſts,—the richneſs and variety of the dreſſes,—the ſumptuouſneſs of the feaſts,—the multitudes of the minſtrels, mimicks, and others whoſe buſineſs it was to amuſe and divert the company, thoſe of my readers who were not preſent would imagine that I was impoſing upon their credulity." The following particular will enable them to form a judgment of the whole. The archbiſhop of York made the king of England a preſent of 60 fat oxen, which made only one article of proviſion for the marriage feaſt, and were all conſumed at that entertainment.

The marriage feaſt of Henry IV. and his queen Jane of Navarre, conſiſted of ſix courſes; three of fleſh and fowls, and three of fiſh. All theſe courſes were accompanied and adorned with *ſutteties*, as they were called. Theſe *ſutteties* were figures in paſtry, of men, women, beaſts, birds, &c. placed on the table, to be admired, but not touched. Each figure had a label affixed to it; containing ſome wiſe or witty ſaying, ſuited to the occaſion of the feaſt, which was the reaſon they were called *ſutteties*. The inſtallation feaſt of George Neville, archbiſhop of York and chancellor of England, exceeded all others in ſplendour and expence, and in the number and quality of the gueſts. The reader may form ſome idea of this enormous feaſt from the following liſt of proviſions prepared for it. In wheat, quarters, 300; in ale, tuns, 300; in wine, tuns, 100; in ipocraſſe, pipes, 1; in oxen, 104; in wild bulls, 6; in muttons, 1000; in veals, 304; in porkes, 304; in ſwanns, 400; in geeſe, 2000; in cappons, 1000; in pigs, 2000; in plovers, 400; in quailes, 1200; in fowls, called recs, 2400; in peacocks, 104; in mallards and teales, 4000; in cranes, 204; in kids, 204; in chickens, 2000; in pigeons, 2000; in connies, 4000; in bittors, 204; in heronſhaws, 400; in pheaſants, 200; in partridges, 500; in woodcocks, 400; in curliews, 100; in egrits, 1000; in ſtaggs, bucks, and roes, 500 and more; in paſties

Feaſt, Feather.

of veniſon, cold, 4000; in parted diſhes of jellies, 1000; in plain diſhes of jellies, 3000; in cold tarts, baked, 4000; in cold cuſtards, baked, 3000; in hot paſties of veniſon, 1500; in hot cuſtards, 2000; in pikes and breams 308; in porpoiſes and ſeals, 12; ſpices, ſugared delicates, and waters, plenty. No turkeys are mentioned in this enormous bill of fare, becauſe they were not then known in England. Cranes, heronſhaws, porpoiſes, and ſeals, are ſeldom ſeen at modern entertainments.

One of the moſt expenſive ſingularities attending the royal feaſts in thoſe days conſiſted in what they called *intermeats*. Theſe were repreſentations of battles, ſieges, &c. introduced between the courſes, for the amuſement of the gueſts. The French excelled in exhibitions of this kind. At a dinner given by Charles V. of France to the emperor Charles IV. A. D. 1378, the following intermeat was exhibited: A ſhip with maſts, ſails, and rigging, was ſeen firſt: ſhe had for colours the arms of the city of Jeruſalem: Godfrey de Bouillon appeared upon deck, accompanied by ſeveral knights armed cap-a-pee: the ſhip advanced into the middle of the hall, without the machine which moved it being perceptible. Then the city of Jeruſalem appeared, with all its towers lined with Saracens. The ſhip approached the city; the Chriſtians landed, and began the aſſault; the beſieged made a good defence: ſeveral ſcaling ladders were thrown down; but at length the city was taken. Intermeats at ordinary banquets conſiſted of certain delicate diſhes introduced between the courſes, and deſigned rather for gratifying the taſte than for ſatisfying hunger.

At thoſe feaſts, beſides the ordinary drinks, ale and cyder, there were great quantities of wines of various kinds. Of theſe laſt, the following lines of a poet who wrote in the fourth century, contain an ample enumeration.

> Ye ſhall have rumney and maleſpine,
> Both ypocraſſe and vernage wyne;
> Mountreſſe and wyne of Greke,
> Both algrade and deſpice eke,
> Antioche and baſtarde,
> Pyment alſo, and garnarde,
> Wyne of Greke and Muſcadell,
> Both clare, pyment, and Rochell.

Some of theſe liquors, as ypocraſs, pyment, and claret, were compounded of wine, honey, and ſpices of different kinds, and in different proportions.

FEATHER, in *Phyſiology*, a general name for the covering of birds; it being common to all the animals of this claſs to have their whole body, or at leaſt the greateſt part of it, covered with feathers or plumage. See ORNITHOLOGY *Index*.

Feathers make a conſiderable article in commerce, particularly thoſe of the oſtrich, heron, ſwan, peacock, gooſe, &c. for plumes, ornaments of the head, filling of beds, writing pens, &c.

Geeſe are plucked in ſome parts of Great Britain five times in the year; and in cold ſeaſons many of them die by this barbarous cuſtom. Thoſe feathers that are brought from Somerſetſhire are eſteemed the beſt, and thoſe from Ireland the worſt.

† See the article *Down*.

Eider down † is imported from Denmark; the ducks that ſupply it being inhabitants of Hudſon's Bay, Greenland, Iceland, and Norway. Our own iſlands weſt of Scotland breed numbers of theſe birds, which turn out a profitable branch of trade to the poor inhabitants. Hudſon's Bay alſo furniſhes very fine feathers, ſuppoſed to be of the gooſe kind. The down of the ſwan is brought from Dantzic. The ſame place alſo ſends us great quantities of the feathers of the cock and hen. The London poulterers ſell a great quantity of the feathers of thoſe birds, and of ducks and turkeys: thoſe of ducks being a weaker feather, are inferior to thoſe of the gooſe; and turkeys feathers are the worſt of any. The beſt method of curing feathers is to lay them in a room, in an expoſure to the ſun; and when dried, to put them in bags, and beat them well with poles to get the dirt off.

Febrifuge ‖ Feciales.

FEBRIFUGE, an appellation given to ſuch medicines as mitigate or remove a fever.

FEBRUARY, in *Chronology*, the ſecond month of Numa's year, and under the protection of the god Neptune. This month is not found in the kalendar of Romulus, but was added to the year by Numa. It had its names from *Februa*, *Februaca*, or *Februalis*, all names of Juno, who preſided over the purifications of women; and in this month the Lupercalia were held in honour of Juno, and women were purified by the prieſts of Pan Lyceus at that feſtival. See LUPERCALIA.

February, in a common year, conſiſts only of 28 days; but in the biſſextile year it has 29, on account of the intercalary day added that year.

FECIALES, or FOECIALES, an order of prieſts or officers, conſiſting of 20 perſons, among the ancient Romans, appointed to proclaim war, negociate peace, &c.

Feſtus derives the word from *ferio*, "I ſtrike;" as *ferire fœdus* ſignifies "to conclude a treaty;" and accordingly, inſtead of *feciales*, he would have it written *feriales*. Others derive it from *fœdus*, which was anciently written *fedus*; or from *fides*, "faith." Others from *facio*, *feci*, "I make," &c. becauſe they made war and peace. Voſſius chooſes to derive it from *fatu*, of the verb *fari*, "to ſpeak": in which ſenſe the *feciales* ſhould be the ſame with *oratores*; which ſentiment is alſo confirmed by the authority of Varro, who ſays they were called indifferently *feciales* and *oratores*.

The feciales were a ſort of heralds, who, when the Romans had any diſpute with their neighbours, were ſent firſt to demand the thing pretended to be uſurped, or require ſatisfaction for the injury alleged to be done. If an anſwer was not returned by them that was ſatisfactory to the people and the ſenate, they were deſpatched again to declare war, and the like in treating for peace; the feciales being the only perſons appointed to negotiate between the ſenate, &c. and the enemy.

Plutarch in the life of Numa, and Halicarnaſſeus (lib. ii.), obſerves, that they were firſt inſtituted by that prince. The latter adds, that they were firſt choſen out of the beſt families in Rome; that their office, which was reputed a ſort of ſacerdotium, or prieſthood, only ended with their life; that their perſons were ſacred and inviolable, as thoſe of other prieſts; that they were even charged to ſee the republic did not declare war unjuſtly; that they were to receive the complaints and

Fecundity, Fee

and remonſtrances of nations who pretended to have been any way injured by the Romans; that if thoſe complaints were found juſt, they were to ſeize the criminals, and deliver them up to thoſe they had offended; that they were inveſted with the rights and privileges of ambaſſadors; that they concluded treaties of peace and alliance, and took care they were executed; and, laſtly, aboliſhed them, if they were found not to be equitable. Livy, lib. i. cap. 24. aſcribes their inſtitution to Ancus Martius, in the year of Rome 114.—Varro aſſures us, that in his time moſt of theſe functions of the feciales were ſet aſide; though Plutarch obſerves, that they had ſtill ſome authority in his time.

The feciales were crowned with *verbena*, "vervain," when they went to declare war. Their head was covered with a veil, over which the crown was applied. In this equipage they proceeded to the frontiers of the new enemy's country, and threw a bloody dart or javelin into the ground within the ſame. In Livy and other ancient authors we have the formula uſed in ſuch declarations.

FECUNDITY, the ſame with FERTILITY.

FEE, in *Law*, ſignifies a complete feudal property. Hence, where the bare liferent of any feudal ſubject is meant to be conveyed to A, and the abſolute property to B, that meaning is expreſſed thus; "to A in liferent, and to B in fee." See LAW, N° lxix. clxiv.

Fees are commonly divided into *abſolute*, otherwiſe called fees-ſimple; and *limited*, one ſpecies of which we uſually call fee-tail.

Blackſt. Comment.

I. Tenant in fee-ſimple (or as he is frequently ſtyled, *tenant in fee*), is he that hath lands, tenements, or hereditaments, to hold to him and his heirs for ever; generally, abſolutely and ſimply; without mentioning what heirs, but referring that to his own pleaſure, or to the diſpoſition of the law. The true meaning of the word *fee* (*feodum*) is the ſame with that of *feud* or *fief*†, and in its original ſenſe it is taken in contradiſtinction to *allodium*; which latter the writers on this ſubject define to be every man's own land, which he poſſeſſeth merely in his own right, without owing any rent or ſervice to any ſuperior. This is property in its higheſt degree; and the owner thereof hath *abſolutum et directum dominium*, and therefore is ſaid to be ſeized thereof abſolutely *in dominico ſuo*, in his own demeſne. But *feodum*, or *fee*, is that which is held of ſome ſuperior, on condition of rendering him ſervice; in which ſuperior the ultimate property of the land reſides. And therefore Sir Henry Spelman defines a feud or fee to be, The right which the vaſſal or tenant hath in lands to uſe the ſame and take the profits thereof to him and his heirs, rendering to the lord his due ſervices; the mere allodial property of the ſoil always remaining in the lord. This allodial property no ſubject in Britain has; it being a received and now undeniable principle in the law, that all the lands are holden mediately or immediately of the king. The king therefore only hath *abſolutum et directum dominium*; but all ſubjects lands are in the nature of *feodum* or *fee*, whether derived to them by deſcent from their anceſtors, or purchaſed for a valuable conſideration; for they cannot come to any man by either of thoſe ways, unleſs accompanied with thoſe feodal clogs which were laid upon the firſt feudatory when it was originally granted. A ſubject therefore hath only the uſufruct, and not the abſolute property, of the ſoil; or, as Sir Edward Coke expreſſes it, he hath *dominium utile*, but not *dominium directum*. And hence it is, that, in the moſt ſolemn acts of law, we expreſs the ſtrongeſt and higheſt eſtate that any ſubject can have, by theſe words, "he is ſeiſed thereof *in his demeſne*, as of fee." It is a man's demeſne, *dominium*, or property, ſince it belongs to him and his heirs for ever: yet this *dominium*, property, or demeſne, is ſtrictly not abſolute or allodial, but qualified or feodal: it is of his demeſne, *as of fee*; that is, it is not purely and ſimply his own, ſince it is held of a ſuperior lord, in whom the ultimate property reſides. Fee.

† See *Feodal* Syſtem.

This is the primary ſenſe and acceptation of the word *fee*. But (as Sir Martin Wright very juſtly obſerves) the doctrine, "that all lands are *holden*," having been for ſo many ages a fixed and undeniable axiom, the Engliſh lawyers do very rarely (of late years eſpecially) uſe the word *fee* in this its primary original ſenſe, in contradiſtinction to *allodium* or abſolute property, with which they have no concern; but generally uſe it to expreſs the continuance or quantity of eſtate. A *fee* therefore, in general, ſignifies an eſtate of inheritance; being the higheſt and moſt extenſive intereſt that a man can have in a feud: and when the term is uſed ſimply, without any other adjunct, or has the adjunct of *ſimple* annexed to it (as, a fee, or a fee-ſimple), it is uſed in contradiſtinction to a fee-conditional at the common law, or a fee-tail by the ſtatute; importing an abſolute inheritance, clear of any condition, limitation, or reſtrictions to particular heirs, but deſcendible to the heirs-general, whether male or female, lineal or collateral. And in no other ſenſe than this is the king ſaid to be ſeiſed in fee, he being the feudatory of no man.

Taking therefore *fee* in this its ſecondary ſenſe, as a ſtate of inheritance, it is applicable to, and may be had in, any kind of hereditaments either corporeal or incorporeal. But there is this diſtinction between the two ſpecies of hereditaments; that of a corporal inheritance a man ſhall be ſaid to be ſeiſed *in his demeſne*, *as of fee*; of an incorporeal one he ſhall only be ſaid to be ſeiſed *as of fee*, and not *in his demeſne*. For as incorporeal hereditaments are in their nature collateral to, and iſſue out of, lands and houſes, their owner hath no property, *dominium*, or demeſne, in the *thing* itſelf, but hath only ſomething derived out of it; reſembling the *ſervitutes*, or ſervices, of the civil law. The *dominium*, or property, is frequently in one man, while the appendage or ſervice is in another. Thus Gaius may be ſeiſed *as of fee*, of a way going over the land, of which Titius is ſeiſed *in his demeſne as of fee*.

The fee-ſimple or inheritance of lands and tenements is generally veſted and reſides in ſome perſon or other; though divers inferior eſtates may be carved out of it. As if one grants a leaſe for 21 years, or for one or two lives, the fee-ſimple remains veſted in him and his heirs; and after the determination of thoſe years or lives, the land reverts to the granter or his heirs, who ſhall hold it again in fee-ſimple. Yet ſometimes the fee may be in *abeyance*, that is (as the word ſignifies) in expectation, remembrance, and contemplation in law; there being no perſon *in eſſe*, in whom it can veſt and abide,

Fee. though the law conſiders it as always potentially exiſting, and ready to veſt whenever a proper owner appears. Thus, in a grant to John for life, and afterwards to the heirs of Richard, the inheritance is plainly neither granted to John nor Richard, nor can it veſt in the heirs of Richard till his death, *nam nemo eſt hæres viventis:* it remains therefore in waiting, or abeyance, during the life of Richard. This is likewiſe always the caſe of a parſon of a church, who hath only an eſtate therein for the term of his life; and the inheritance remains in abeyance. And not only the fee, but the freehold alſo, may be in abeyance; as, when a parſon dies, the freehold of his glebe is in abeyance until a ſucceſſor be named, and then it veſts in the ſucceſſor.

The word *heirs* is neceſſary in the grant or donation, in order to make a fee or inheritance. For if land be given to a man for ever, or to him and his aſſigns for ever, this veſts in him but an eſtate for life. This very great nicety about the inſertion of the word *heirs* in all feoffments and grants, in order to veſt a fee, is plainly a relick of the feodal ſtrictneſs: by which it was required, that the form of the donation ſhould be punctually purſued; or that, as Craig expreſſes it, in the words of Baldus, *donationes ſint ſtricti juris, ne quis plus donâſſe præſumatur quam in donatione expreſſerit.* And therefore, as the perſonal abilities of the donee were originally ſuppoſed to be the only inducements to the gift, the donee's eſtate in the land extended only to his own perſon, and ſubſiſted no longer than his life; unleſs the donor, by an expreſs proviſion in the grant, gave it a longer continuance, and extended it alſo to his heirs. But this rule is now ſoftened by many exceptions.

For, 1. It does not tend to deviſes by will; in which, as they were introduced at the time when the feodal rigour was apace wearing out, a more liberal conſtruction is allowed: and therefore by a deviſe to a man for ever, or to one and his aſſigns for ever, or to one in fee-ſimple, the deviſee hath an eſtate of inheritance; for the intention of the deviſor is ſufficiently plain from the words of perpetuity annexed, though he hath omitted the legal words of inheritance. But if the deviſe be to a man and his aſſigns, without annexing words of perpetuity, there the deviſee ſhall take only an eſtate for life; for it does not appear that the deviſor intended any more. 2. Neither does this rule extend to fines or recoveries, conſidered as a ſpecies of conveyance; for thereby an eſtate in fee paſſes by act and operation of law without the word *heirs:* as it does alſo, for particular reaſons, by certain other methods of conveyance, which have relation to a former grant or eſtate, wherein the word *heirs* was expreſſed. 3. In creations of nobility by writ, the peer ſo created hath an inheritance in his title, without expreſſing the word *heirs;* for they are implied in the creation, unleſs it be otherwiſe ſpecially provided: but in creations by patent, which are *ſtricti juris*, the word *heirs* muſt be inſerted, otherwiſe there is no inheritance. 4. In grants of lands to ſole corporations and their ſucceſſors, the word *ſucceſſors* ſupplies the place of *heirs;* for as heirs take from the anceſtor, ſo doth the ſucceſſor from the predeceſſor. Nay, in a grant to a biſhop, or other ſole ſpiritual corporation, in *frankalmoign*, the word *frankalmoign* ſupplies the place of *ſucceſſors* (as the word *ſucceſſors* ſupplies the place of *heirs*) *ex vi termini*; and in all theſe caſes a fee-ſimple veſts in ſuch ſole corporation. But, in a grant of lands to a corporation aggregate, the word *ſucceſſors* is not neceſſary, though uſually inſerted: for, albeit ſuch ſimple grant be ſtrictly only an eſtate for life, yet as that corporation never dies, ſuch eſtate for life is perpetual, or equivalent to a fee-ſimple, and therefore the law allows it to be one. Laſtly, In the caſe of the king, a fee-ſimple will veſt in him, without the words *heirs or ſucceſſors* in the grant; partly from prerogative royal and partly from a reaſon ſimilar to the laſt, becauſe the king, in judgment of law, never dies. But the general rule is, that the word *heirs* is neceſſary to create an eſtate of inheritance. Fee.

II. We are next to conſider limited fees, or ſuch eſtates of inheritance as are clogged and confined with conditions or qualifications of any ſort. And theſe we may divide into two ſorts: 1. *Qualified* or *baſe* fees; and, 2. Fees *conditional*, ſo called at the common law; and afterwards fees-*tail*, in conſequence of the ſtatute *de donis*.

1. A BASE or qualified fee, is ſuch a one as has a qualification ſubjoined thereto, and which muſt be determined whenever the qualification annexed to it is at an end. As, in the caſe of a grant to A and his heirs, tenants in the manor of Dale; in this inſtance, whenever the heirs of A ceaſe to be tenants of that manor, the grant is entirely defeated. So, when Henry VI. granted to John Talbot, lord of the manor of Kingſton Liſle in Berks, that he and his heirs, lords of the ſaid manor, ſhould be peers of the realm, by the title of *Barons of Liſle;* here John Talbot had a baſe or qualified fee in that dignity; and the inſtant he or his heirs quitted the ſeigniory of this manor, the dignity was at an end. This eſtate is a fee, becauſe by poſſibility it may endure for ever in a man and his heirs; yet as that duration depends upon the concurrence of collateral circumſtances, which qualify and debaſe the purity of the donation, it is therefore a qualified or baſe fee.

2. As to fees-*conditional*, or fee-*tail*, ſee the article TAIL.

FEE alſo ſignifies a certain allowance to phyſicians, barriſters, attorneys, and other officers, as a reward for their pains and labour.

If a perſon refuſe to pay an officer his due fees, the court will grant an attachment againſt him, to be committed till the fees are paid; and an attorney may bring an action of the caſe for his fees againſt the client that retained him in his cauſe.

FEE alſo denotes a ſettled perquiſite of public officers, payable by thoſe who employ them.

The fees due to the officers of the cuſtom-houſe are expreſsly mentioned in a ſchedule, or table, which is hung up in public view in the ſaid office, and in all other places where the ſaid fees are to be paid or received. And if any officer ſhall offend, by acting contrary to the regulations therein contained, he ſhall forfeit his office and place, and be for ever after incapable of any office in the cuſtom-houſe.

The other public offices have likewiſe their ſettled fees, for the ſeveral branches of buſineſs tranſacted in them.

FEE *Farm*, a kind of tenure without homage, fealty, or other ſervice, except that mentioned in the feoffment;

Feelers || Felling.

ment; which is usually the full rent, or at least a fourth part of it.

The nature of this tenure is, that if the rent be behind, and unpaid for two years, then the feoffor and his heirs may have an action for the recovery of the lands.

FEELERS, in *Natural History*, a name used by some for the horns of INSECTS.

FEELING, one of the five external senses, by which we obtain the ideas of solid, hard, soft, rough, hot, cold, wet, dry, and other tangible qualities. See ANATOMY *Index*.

FEET. See FOOT.

Feet-Bearer, the name of an officer in the courts of the ancient Anglo-Saxon and Welsh kings. He was a young gentleman whose duty it was to sit on the floor, with his back towards the fire, and hold the king's feet in his bosom all the time he sat at table, to keep them warm and comfortable†: a piece of state and luxury unknown in modern times.

† *Leges Wallicæ*, p. 58.

FEINT, in fencing, a show of making a thrust at one part, in order to deceive the enemy, that you may really strike him in another.

A simple feint is a mere motion of the wrist, without stirring the foot.

FELAPTON, in *Logic*, one of the six first modes of the third figure of syllogisms; whereof the first proposition is an universal negative, the second an universal affirmative, and the third a particular negative.

FELIBIEN, ANDRE, was born at Chartres in 1619, and went secretary under the Marquis de Fontenay Mareuil ambassador to the court of Rome in 1647. On his return, M. Colbert procured him the places of historiographer to the king, superintendant of his buildings, and of the arts and manufactures in France. He became afterwards deputy comptroller general of the bridges and dykes in that kingdom; and died in 1695. He wrote several pieces relating to the fine arts: the principal of which is his "Dialogues on the Lives and Works of the most eminent Painters."

FELICITAS, (FELICITY, or *Happiness*), was deified by the ancient Pagans. Lucullus built a temple to her. She had another erected by Lepidus. The Greeks paid divine worship to *Macaria*, daughter of Hercules, the same with *Felicitas*. This deity is often pictured upon medals, and generally with a cornucopiæ in one hand, and a caduceus in the other. The inscriptions are, *Felicitas Temporum*, *Felicitas Augusti*, *Felicitas Publica*, &c.

FELIS, a genus of quadrupeds belonging to the order of feræ, and class mammalia. See MAMMALIA *Index*.

FELLING *of* TIMBER.—Many circumstances are well known and constantly observed in the felling of timber for building, which, though to a hasty observer, they might appear trifling, yet prove, on experience, to be of the utmost consequence. One thing observed by M. de Buffon, which very greatly increases the solidity and strength of timber, is, that the trees intended to be felled for service should first be stripped of their bark, and suffered to stand and die upon the spot before the cutting. The sappy part or blea of the oak becomes by this means as hard and firm as the heart; and the real strength and density of the wood has been proved, by many experiments, to be greatly increased by it: nor is this a practice of any detriment to the proprietor, since the remaining stumps of these trees send up their young shoots as vigorously as if they had been cut down in their natural condition.

Fellowship || Felony.

When any tree is to be cut down for timber, the first thing to be taken care of is a skilful disbranching of such limbs as may endanger it in its fall: many trees are utterly spoiled for want of a previous care of this kind. In arms of timber that are very great, it is always necessary to chop or sink in them close to the bole, and then meeting it with downright strokes, it will be severed from the tree without splitting. In felling the tree, take care always to cut it as close to the ground as possible, unless it is intended to be grubbed up: and the doing that is of advantage both to the timber and to the wood; for timber is never so much valued, if it be known to grow out of old stocks.

FELLOWSHIP, COMPANY, or *Distributive Proportion*, in *Arithmetic*. See ARITHMETIC.

FELO DE SE, in *Law*, a person that lays deliberately violent hands on himself, and is the occasion of his untimely death, whether by hanging, drowning, stabbing, shooting, or any other way.

FELON, in *Law*, a person guilty of felony. See FELONY.

FELONY, in the general acceptation of the law, comprises every species of crime, which occasions at common law the forfeiture of lands or goods. This most frequently happens in those crimes for which a capital punishment either is or was to be inflicted: for those felonies that are called *clergyable*, or to which the benefit of clergy extends, were anciently punished with death in all lay or unlearned offenders; though now, by the statute law, that punishment is for the first offence universally remitted. Treason itself, says Sir Edward Coke, was anciently comprised under the name of *felony*; and in confirmation of this we may observe, that the statute of treasons, 25 Edw. III. c. 2. speaking of some dubious crimes, directs a reference to parliament; that it may be there adjudged, "whether they be treason or *other* felony." All treasons, therefore, strictly speaking, are felonies; though all felonies are not treason. And to this also we may add, that all offences, now capital, are in some degree or other felony; but this is likewise the case with some other offences, which are not punished with death; as suicide, where the party is already dead; homicide by chance-medley, or in self-defence; and petit-larceny, or pilfering; all which are (strictly speaking) felonies, as they subject the committers of them to forfeitures. So that, upon the whole, the only adequate definition of felony seems to be that which is before laid down; viz. an offence which occasions a total forfeiture of either lands or goods, or both, at the common law; and to which capital or other punishment may be superadded, according to the degree of guilt.

To explain this matter a little farther: The word *felony*, or *felonia*, is of undoubted feodal original, being frequently to be met with in the books of feuds, &c. but the derivation of it has much puzzled the juridical lexicographers, Prateus, Calvinus, and the rest: some deriving it from the Greek, φηλος, "an impostor or deceiver;" others from the Latin, *fallo*, *fefelli*, to counte-

nance

Felony. nance which they would have it called *fellonia*. Sir Edward Coke, as his manner is, has given us a ſtill ſtranger etymology; that it is *crimen animo felleo perpetratum*, "with a bitter or galliſh inclination." But all of them agree in the deſcription, that it is ſuch a crime as works a forfeiture of all the offender's lands or goods. And this gives great probability to Sir Henry Spelman's Teutonic or German derivation of it: in which language, indeed, as the word is clearly of feodal original, we ought rather to look for its ſignification, than among the Greeks and Romans. *Fe-lon* then, according to him, is derived from two northern words: FEE, which ſignifies (we well know) the fief, feud, or beneficiary eſtate; and LON, which ſignifies price or value. Felony is therefore the ſame as *pretium feudi*, the conſideration for which a man gives up his fief; as we ſay in common ſpeech, ſuch an act is as much as your life or eſtate is worth. In this ſenſe it will clearly ſignify the feodal forfeiture, or act by which an eſtate is forfeited, or eſcheats to the lord.

To confirm this, we may obſerve, that it is in this ſenſe, of forfeiture to the lord, that the feodal writers conſtantly uſe it. For all thoſe acts, whether of a criminal nature or not, which at this day are generally forfeitures of copyhold eſtates, are ſtyled *feloniæ* in the feodal law: "*ſcilicet, per quas feudum amittitur.*" As "*ſi domino deſervire noluerit;—ſi per annum et diem ceſſaverit in petenda inveſtitura;—ſi dominum ejuravit*, i. e. *negavit ſe a domino feudum habere;—ſi a domino in jus eum vocante, ter citatus non comparuerit*:"—all theſe, with many others, are ſtill cauſes of forfeiture in our copyhold eſtates, and were denominated *felonies* by the feodal conſtitutions. So likewiſe injuries of a more ſubſtantial or criminal nature were denominated *felonies*, that is, forfeitures: as aſſaulting or beating the lord; vitiating his wife or daughter, "*ſi dominum cucurbitaverit*, i. e. *cum uxore ejus concubuerit*; all theſe are eſteemed felonies, and the latter is expreſsly ſo denominated, "*ſi fecerit feloniam, dominum forte cucurbitando.* And as theſe contempts, or ſmaller offences, were felonies or acts of forfeiture, of courſe greater crimes, as murder and robbery, fell under the ſame denomination. On the other hand, the lord might be guilty of felony, or forfeit his ſeignory to the vaſſal, by the ſame act as the vaſſal would have forfeited his feud to the lord. "*Si dominus commiſit feloniam, per quam vaſallus amitteret feudum ſi eam commiſerit in dominum, feudi proprietatem etiam dominus perdere debet.*" One inſtance given of this ſort of felony in the lord is beating the ſervant of his vaſſal, ſo as that he loſes his ſervice; which ſeems merely in the nature of a civil injury, ſo far as it reſpects the vaſſal. And all theſe felonies were to be determined, "*per laudamentum ſive judicium parium ſuorum*," in the lord's court; as with us forfeitures of copyhold lands are preſentable by the homage in the court-baron.

Felony, and the act of forfeiture to the lord, being thus ſynonymous terms in the feodal law, we may eaſily trace the reaſon why, upon the introduction of that law into England, thoſe crimes which induced ſuch forfeiture or eſcheat of lands (and, by a ſmall deflection from the original ſenſe, ſuch as induced the forfeiture of goods alſo) were denominated *felonies*. Thus it was that ſuicide, robbery, and rape, were felonies; that is, the conſequence of ſuch crimes was forfeiture; till by long uſe we began to ſignify by the term of *felony* the actual crime committed, and not the penal conſequence. And upon this ſyſtem only can we account for the cauſe, why treaſon in ancient times was held to be a ſpecies of felony; viz. becauſe it induced a forfeiture. Felony & Felling.

Hence it follows, that capital puniſhment does by no means enter into the true idea and definition of *felony*. Felony may be without inflicting capital puniſhment, as in the caſes inſtanced of ſelf-murder, excuſable homicide, and petit-larceny: and it is poſſible that capital puniſhments may be inflicted, and yet the offence be no felony; as in caſe of hereſy by the common law, which, though capital, never worked any forfeiture of lands or goods, an inſeparable incident to felony. And of the ſame nature was the puniſhment of ſtanding mute, without pleading to an indictment; which at the common law was capital, but without any forfeiture, therefore ſuch ſtanding mute was no felony. In ſhort, the true criterion of felony is forfeiture: for, as Sir Edward Coke juſtly obſerves, in all felonies which are puniſhable with death, the offender loſes all his lands in fee-ſimple, and alſo his goods and chattels; in ſuch as are not puniſhable, his goods and chattels only.

The idea of felony is indeed ſo generally connected with that of capital puniſhment, that we find it hard to ſeparate them; and to this uſage the interpretations of the law do now conform. And therefore, if a ſtatute makes any new offence felony, the law implies that it ſhall be puniſhed with death, viz. by hanging, as well as with forfeiture: unleſs the offender prays the benefit of clergy; which all felons are entitled once to have, unleſs the ſame is expreſsly taken away by ſtatute.

Felonies by ſtatute are very numerous; and as this work will not admit of a proper enumeration, we muſt refer to the table of the quarto edition of the Statutes, where they are ſet forth in alphabetical order.

FELT, in *Commerce*, a ſort of ſtuff deriving all its conſiſtence merely from being fulled, or wrought with lees and ſize, without either ſpinning or weaving. Felt is made either of wool alone or of wool and hair.

FELTING, the method of working up hair or wool into a ſpecies of cloth, independent of either ſpinning or weaving. Felting in Britain is not much practiſed, except in the manufacturing of hats; and as the generality even of thoſe who are employed in making them, are unacquainted with the principles on which they act, a few obſervations on the method of felting may, to ſuch, be both uſeful and agreeable.

If wool, the hair of a rabbit, hare, beaver, or human hair, be examined with a microſcope of the greateſt magnifying power, the ſurface of each hair appears perfectly ſmooth, or if any inequalities are obſerved, they do not appear ſo much to ariſe from an irregular ſurface, as from ſome peculiar difference in the colour and tranſparency of the ſubſtances examined; for if their image be viewed by a ſolar microſcope, it terminates in even lines, without the ſmalleſt veſtige of any roughneſs. Yet nothing is more evident than that the ſurfaces of hairs are not perfectly ſmooth, but either compoſed of lamellæ covering each other from the root to the point, reſembling the ſcales of fiſhes; or what ſome have deemed

more

Felting. more probable, of zones placed over each other, similar to the ſtructure of horns; and to this texture hair, wool, &c. owe their diſpoſition for what is denominated felting.

Let a perſon take hold of a hair by the root with one hand, and draw it between two fingers of the other, from the root towards the point, he will ſcarcely perceive any friction, or hear any ſound; but ſhould he hold the hair by the point, and draw it between his fingers from the point towards the root, he will feel a ſenſible oppoſition or reſiſtance which could not be felt before. A ſort of tremulous motion is likewiſe produced, which can be diſtinguiſhed by the ear. From this ſimple experiment it is obvious that the texture of the ſurface of a hair is not the ſame from the point to the root, as it is from the root to the point. If a hair is taken hold of by the fore-finger and thumb, and rubbed in a longitudinal direction, a progreſſive motion is the reſult, which is invariably towards the root. This is wholly independent of the texture or nature of the ſkin of the fingers; for if the hair be turned, and the point of it placed where the root formerly was, the movement becomes contrary, or, in other words, it is ſtill directed towards the root.

It is found a very difficult taſk to untie a knot made in the middle of a hair, on account of its extreme thinneſs; but if the hair is placed in the bend of the hand, the knot being in a line with the little finger, and if the hair is graſped by cloſing the hand, and the fiſt ſtruck ſeveral times againſt the knee, the knot is thereby opened, becauſe the aſperities of one end of the hair are in a contrary direction to thoſe of the other, by which means each end of it recedes a little. By the introduction of a pin into the eye thus formed at the knot, it is eaſily untied. Although theſe obſervations have a direct reference to long hair; yet they are equally applicable to wool, furs, and almoſt every ſpecies of animal hair. The ſurfaces of all theſe conſiſt of hard *lamellæ*, placed upon each other like tiles, in the direction from the root to the point.

By attending to theſe remarks, it is eaſy to ſee why the contact of woollen ſtuffs is rough to the ſkin. The aſperities on the ſurface of the fibres of wool produce a diſagreeable ſenſation, by fixing themſelves in the ſkin, which can only be endured by being accuſtomed to feel it frequently. The injury done to wounds by the application of wool, is not the reſult of any chemical property, but is entirely occaſioned by the aſperities of its ſurface.

A hatter ſeparates the hairs from each other, by ſtriking the wool with the ſtring of his bow, cauſing them to ſpring up in the air, which fall on the table in every poſſible direction, forming a layer of a particular thickneſs, which is covered by the workmen with a cloth, preſſing it with his hands, and moving the hairs backwards and forwards in different directions. In this manner the hairs are brought againſt each other, and their points of contact conſiderably multiplied, and the agitation gives each hair a progreſſive motion towards the root, in conſequence of which the hairs become twiſted together. As the maſs becomes compact, the preſſure ought to be increaſed, in order to keep up the progreſſive motion and twiſting of the hairs, which is then performed with greater difficulty.

The hair deſigned for the manufacturing of hats is always cut off with a ſharp inſtrument, and not pulled out by the roots, becauſe the bulb of the hair which would come out with it in the latter caſe, would render the end which was fixed in the ſkin very obtuſe, and nearly deſtroy its diſpoſition to unite with the adjacent hairs. But in addition to the tendency of hairs to move progreſſively towards the root, they ſhould not be ſtraight like needles, for in this caſe they could not produce any compactneſs in the ſtuff. The fibres of wool having naturally a crooked form, that ſubſtance is well adapted to the operation of felting. The hair of beavers, rabbits, hares, &c. being ſtraight, it cannot be employed in felting by itſelf, till it has been ſubjected to a previous preparation, viz. rubbing and combing on the ſkin, the bruſh being dipped in a ſolution of mercury in nitric acid. This ſubſtance, by acting only on one ſide of the hairs, gives them that diſpoſition to felting which is natural to wool.

When it is not intended that the hairs ſhall enter into the body of the maſs, but ſerve only as an external coating, which is ſometimes given to the outer ſurface of hats, the operation with the nitric acid need not be performed. They muſt be uniformly ſpread upon the ſurface to which the coating is to be applied, and being covered with a cloth, it is preſſed with the hands, and agitated for ſome time. They receive a particular direction afterwards by means of a bruſh, and are enabled to keep it by having a hot iron paſſed over them. Woollen cloth is thickened by fulling, on the ſame principles that wool and hair become capable of felting.

Felt-Spar || Feminine.

Felt-Spar or *Feld-Spar*, a mineral ſubſtance. See Mineralogy *Index*.

FELTRIA, in *Ancient Geography*, a town on the borders of Rhætia towards Italy. Now *Feltri*, in the territory of Venice, on the Piava. E. Long. 12. 16. N. Lat. 46. 0.

FELUCCA, in ſea affairs, a little veſſel rowed with ſix oars, frequent in the Mediterranean; which has this peculiarity, that its helm may be applied either in the head or ſtern, as occaſion requires.

FEMALE, (FOEMINA), a term peculiar to animals, ſignifying that ſex which conceives and generates its young within itſelf. See Sex and Generation.

Female is alſo applied, figuratively, to things without life, from the reſemblance they bear to the females of animals. Thus we ſay a

Female Screw. See Screw.

Female Flower. See *Fœmineus Flos*.

Female Plant. See *Fœminea Planta*.

FEMME covert, in *Law*, a married woman. See Coverture.

Femme Sole, an unmarried woman, whoſe debts, contracted before marriage, become thoſe of her huſband after it.

A femme ſole merchant, is where a woman, in London, uſes a trade alone, without her huſband; on which account ſhe ſhall be charged without him.

FEMININE, in *Grammar*, one of the genders of nouns. See Gender.

The feminine gender is that which denotes the noun or name to belong to a female. In the Latin, the feminine gender is formed of the maſculine, by altering its termination; particularly by changing *us* into *a*. Thus,

Femur, Fen.

Thus, of the maſculine *bonus equus*, "a good horſe," is formed the feminine *bona equa*, "a good mare;" ſo, of *parvus homo*, "a little man," is formed *parva fœmina*, "a little woman," &c.

In French, the feminine gender is expreſſed, not by a different termination, but by a different article: thus, *le* is joined to a male, and *la* to a female.

In Engliſh, we are generally more ſtrict, and expreſs the difference of ſex, not by different terminations, nor by different particles, but different words; as boar and ſow, boy and girl, brother and ſiſter, &c. —though ſometimes the feminine is formed by varying the termination of the male into *eſs*; as in abbot, abbeſs, &c.

FEMUR, os FEMORIS, the thigh bone. See ANATOMY *Index*.

FEN, a place overflowed with water, or abounding with bogs. See BOG and DRAINING, in AGRICULTURE *Index*.

Fens are either made up of a congeries of bogs; or conſiſt of a multitude of pools or lakes, with dry ſpots of land intermixed, like ſo many little iſlands.

Several ſtatutes have been made for the draining of fens, chiefly in Kent, Cambridgeſhire, Bedfordſhire, and Lincolnſhire; and by a late act, 11 Geo. II. commiſſioners ſhall be appointed for the effectually draining and preſerving of the fens in the iſle of Ely, who are authorized to make drains, dams, and proper works thereon; and they may charge the landholders therein with a yearly acre-tax, and in default of payment, ſell the defender's lands.

The wet grounds called *fens*, in Lincolnſhire and elſewhere in England, bring many advantages to the inhabitants of thoſe counties. Fowl and fiſh are very plentiful in them. The pike and eels are large and eaſily caught, but they are uſually coarſe. The duck, mallard, and teal, are in ſuch plenty as is ſcarce to be conceived. They are taken by DECOYS in prodigious flocks at a time. They ſend theſe fowl from Lincolnſhire to London, twice a-week, on horſeback, from Michaelmas to Lady-day; and one decoy will furniſh 20 dozen, or more, twice a-week, for the whole ſeaſon in this manner. The decoy-men contract with the people, who bring them to London at a certain rate, and they are obliged to take off their hands the whole number that is catched. Two teal are uſually reckoned equal to one duck; and ſix ducks and twelve teal are accounted a dozen of wild fowl; and the uſual market price is about 9s. for ſuch a dozen. About midſummer, during the moulting ſeaſon, a great number alſo are deſtroyed by the people in the neighbourhoods. The poor birds at this ſeaſon are neither able to ſwim nor fly well; and the people going in with boats among the reeds where they lie, knock them down with long poles. A little before Michaelmas, vaſt flights of theſe birds arrive at the decoys from other places; they ſoon grow fat in them, and continue there a prey to the maſters or owners, as long as the decoys are unfrozen; but, when they are iced over, they fly away again, and go to the neighbouring ſeas for food.

The fens alſo abound in a ſort of herbage that is very nouriſhing to cattle. Sheep and horſes always grow fat upon it. The fens are common, and the owners of cattle mark them that they may be known. It is remarkable, that, though all is open, the cattle uſed to one particular ſpot of ground ſeldom leave it, but the owner may always find them in or near the ſame place. The fens have many large and deep drains. In theſe the pike and eel grow to a vaſt ſize: and they are full of geeſe which feed on the graſs; but theſe eat rank and muddy, and may even be ſmelt as ſoon as a perſon comes into the room where they are roaſting. But the people have another very great advantage from theſe birds beſides the eating of them, namely, their feathers and quills; and the produce of theſe is ſo great, that the cuſtomhouſe books in the town of Boſton ſhow, that there are frequently ſent away in one year 300 bags of feathers, each containing a hundred and a half weight. Each pound of feathers brings in the owner twopence; and it may be thought ſtrange by people unacquainted with theſe things, but it is a certain truth, that the owners pull them five or ſix times a year for the feathers, and three times for the quills. Each pulling comes to about a pound, and many people have 1000 geeſe at a time, or more. They are kept at no charge, except in deep ſnowy weather, when they are obliged to feed them with corn.

Fen, Fence.

Oats alſo grow very well in many of the fen countries, and in good ſeaſons bring great increaſe and advantage to the owners. There is alſo another vegetable of great profit to them. This is the *rapum ſilveſtre*; the ſeed of which they call *cole-ſeed*; and they make an oil from it of great uſe in trade. They grind the ſeed between two large ſtones, the one ſtanding perpendicularly on the other. The ſtones are made of a ſort of black marble, and are brought from Germany. They ſometimes turn them by ſails, and ſometimes by the drains which carry off the water from the fen lands.

The fens lying low, and being of a vaſt extent, are very ſubject to be overflowed by waters from the neighbouring high countries; and though great care and expence is uſed to keep them dry, they are often like a ſea; and the ſheep are obliged to be carried off in boats, and the people to live in their upper rooms, and to be ſupplied with proviſions alſo with boats.

FENCE, in *Gardening* and *Huſbandry*, a hedge, wall, ditch, bank, or other incloſure, made round gardens, fields, woods, &c.

In hot climates, where they have not occaſion for walls to ripen their fruit, their gardens lie open, where they can have a water fence, and proſpects; or elſe they bound their gardens with groves, in which are fountains, walks, &c. which are much more pleaſing to the ſight than a dead wall: but, in colder countries, we are obliged to have walls to ſhelter and ripen our fruit, although they take away much from the pleaſant proſpect of the garden. Brick walls are accounted the beſt and warmeſt for fruit: and theſe walls, being built pannelwiſe, with pillars at equal diſtances, will ſave a great deal of charge, in that the walls may be built thinner than if they were made plain without theſe pannels, for then it would be neceſſary to build them thicker everywhere; and, beſides, theſe pannels make the walls look the handſomer. Stone walls, however, on account of their durability, are to be preferred to thoſe of brick, eſpecially thoſe of ſquare hewn ſtones. Theſe that are made of rough ſtones, though

Fence. though they are very dry and warm, yet, by reaſon of their unevenneſs, are inconvenient to nail up trees to, except pieces of timber be laid in them here and there for that purpoſe.

But, in large gardens, it is better to have the proſpect open to the pleaſure garden; which ſhould be ſurrounded with a foſſe, that from the garden the adjacent country may be viewed. But this muſt depend on the ſituation of the place: for, if the proſpect from the garden is not good, it had better be ſhut out from the ſight than be open. As alſo, when a garden lies near a populous town, and the adjoining grounds are open to the inhabitants; if the garden is open, there will be no walking there in good weather, without being expoſed to the view of all paſſengers, which is very diſagreeable.

Miller's Gardener's Dictionary. Where the foſſes are made round a garden which is ſituated in a park, they are extremely proper; becauſe hereby the proſpect of the park will be obtained in the garden, which renders thoſe gardens much more agreeable than thoſe that are confined.—In the making theſe foſſes there have been many inventions; but, upon the whole, none ſeem preferable to thoſe which have an upright wall next the garden, which (where the ſoil will admit of a deep trench) ſhould be five or ſix feet high; and, from the foot of this wall, the ground on the outſide ſhould riſe with a gradual eaſy ſlope, to the diſtance of 18 or 20 feet; and where it can be allowed, if it ſlopes much farther it will be eaſier, and leſs perceptible as a ditch, to the eye, when viewed at a diſtance; but, if the ground is naturally wet, ſo as not to admit a deep foſſe, then, in order to make a fence againſt cattle, if the wall be four feet high, and ſlight poſts of three feet high are placed juſt behind the wall, with a ſmall chain carried on from poſt to poſt, no cattle or deer will ever attempt to jump againſt it; therefore it will be a ſecure fence againſt them; and if theſe are painted green, they will not be diſcerned at a diſtance, and at the ſame time the chain will ſecure perſons walking in the garden from tumbling over.

In places where there are no good proſpects to be obtained from a garden, it is common to make the encloſure of park paling; which, if well performed, will laſt many years, and has a much better appearance than a wall; and this pale may be hid from the ſight within, by plantations of ſhrubs and evergreens; or there may be a quick hedge planted within the pale, which may be trained up, ſo as to be an excellent fence by the time the pales begin to decay.

Fences round parks are generally of paling; which, if well made of winter-fallen oak, will laſt many years. But a principal thing to be obſerved, in making theſe pales, is not to make them too heavy: for, when they are ſo, their own weight will cauſe them to decay: therefore the pales ſhould be cleft thin; and the rails ſhould be cut triangular, to prevent the wet lodging upon them; and the poſts ſhould be good, and not placed too far aſunder. If theſe things are obſerved, one of theſe pales will laſt, with a little care, upwards of 40 years very well. The common way of making theſe fences is, to have every other pale nine or ten inches above the intermediate ones; ſo that the fence may be ſix feet and a half high, which is enough for fallow deer; but, where there are red deer, the fence ſhould be one foot higher, otherwiſe they will leap over. Fence-Month, Fencing.

Some encloſe their parks with brick walls; and in countries where ſtone is cheap, the walls are built with this material; ſome with, and others without, mortar.

A kitchen garden, if rightly contrived, will contain walling enough to afford a ſupply of ſuch fruits as require the aſſiſtance of walls, for any family; and this garden, being ſituated on one ſide, and quite out of ſight of the houſe, may be ſurrounded with walls which will ſcreen the kitchen garden from the ſight of perſons in the pleaſure garden; and, being locked up, the fruit will be much better preſerved than it can be in the public garden; and the having too great a quantity of walling is often the occaſion that ſo many ill managed trees are frequently to be ſeen in large gardens.

The height of garden walls ſhould be 12 feet, which is a moderate proportion; and, if the ſoil be good, it may in time be well furniſhed with bearing wood in every part, eſpecially that part planted with pears, notwithſtanding of the branches being trained horizontally from the bottom of the walls.

With regarded to the different kinds of fences. See AGRICULTURE *Index*.

Fence-Month, the month wherein deer begin to fawn, during which it is unlawful to hunt in the foreſt.

It commences 15 days before Midſummer, and ends 15 days after it. This month, by ancient foreſters, is called *defence-month*.

FENCING, the art of making a proper uſe of the ſword, as well for attacking an enemy as for defending one's ſelf.

This art is acquired by practiſing with foils, called in Latin *rudes*; whence fencing is alſo denominated *gladiatura rudiaria*.—It is one of the exerciſes learnt in the academies (ſee EXERCISE and ACADEMY); and is an accompliſhment both agreeable and uſeful:—Agreeable, as it affords gentlemen a noble and diſtinguiſhed amuſement:—Uſeful, as it forms their body; and furniſhes them with the faculty of defence, whether it be of their honour or their life, when the one or the other is attacked by thoſe turbulent and dangerous perſons whoſe correction is of ſervice to ſociety in general.

Pyrard aſſures us, that the art of fencing is ſo highly eſteemed in the Eaſt Indies, that none but princes and noblemen are allowed to teach it. They wear a badge or cognizance on their right arms, called in their language *eſaru*; which is put on with great ceremony, like the badges of our orders of knighthood, by the kings themſelves.

Fencing is divided into two parts, *ſimple* and *compound*.

Simple is that performed directly and nimbly, on the ſame line; and is either offenſive or defenſive.—The principal object of the firſt, is whatever may be attempted, in puſhing or making paſſes, from this or that point, to the moſt uncovered part of the enemy. The ſecond conſiſts in parrying and repelling the thruſts aimed by the enemy.

The *compound* includes all the poſſible arts and inventions to deceive the enemy, and make him leave that part we have a deſign on bare and unguarded, upon finding

Fenelon || Fenton.

finding we cannot come at it by force, nor by the agility of the ſimple play. The principal means hereof are, on the offenſive ſide, feints, appeals, claſhings, and entanglings of ſwords, half thruſts, &c. and, on the defenſive, to puſh in parrying. Of all which a detail would be here uſeleſs, as they are only to be underſtood and acquired from perſonal inſtructions conjoined with practice.

FENELON, Francis de Salignac de la Motte, was of an ancient and illuſtrious family, and born at the caſtle of Fenelon in Perigord in 1651. In 1689, he was appointed tutor to the dukes of Burgundy and Anjou; and in 1655 was conſecrated archbiſhop of Cambray. After this preferment, a ſtorm aroſe againſt him, that obliged him to leave the court for ever, occaſioned by his performance entitled, An Explication of the Maxims of the Saints concerning the Interior Life; in which he was ſuppoſed to favour the extravagant notions of Madame Guyon, and the principles of Quietiſm. A controverſy on this occaſion was for ſome time carried on between him and M. Boſſuet, biſhop of Meaux: which terminated in an appeal to the pope; when his holineſs condemned the archbiſhop's book, by a brief dated March 12. 1699. Some friends indeed pretend, that there was more of court policy than religious zeal in this affair: but be this as it may, the archbiſhop ſubmitted patiently to this determination; and, retiring to his dioceſe of Cambray, acquitted himſelf punctually in all the duties of his ſtation, and led a moſt exemplary life. The work that gained him the greateſt reputation, and which will render his memory immortal, is his Adventures of Telemachus; the ſtyle of which is natural, the fictions well contrived, the moral ſublime, and the political maxims tending all to the happineſs of mankind. Hence it is thought, as the printing of this work was ſtopped at Paris, that the prelate's hereſy was in politics inſtead of religion; and though his diſgrace was prior to this work, he had, while he was tutor to the young princes, taught them the ſame principles aſſerted and exemplified in Telemachus. Fenelon died in 1715; and a collection of all his religious works was afterwards printed at Rotterdam, under the care of the marquis de Fenelon his grand-nephew, when ambaſſador to the States-General.

FENNEL. See Anethum, Botany *Index*.

FENTON, Sir Geoffroy, privy counſellor and ſecretary in Ireland during the reigns of Queen Elizabeth and King James I. is well known for his tranſlation of Guicciardini's Hiſtory of the Wars of Italy, dedicated to Queen Elizabeth in 1579. He died at Dublin in 1608; after having married his daughter to Mr Boyle, afterward the great earl of Corke.

Fenton, *Elijah*, deſcended from an ancient family, was born at Shelton near Newcaſtle, but in what year is uncertain. He was the youngeſt of 12 children, and was intended for the miniſtry; but embracing principles contrary to the government, while at Cambridge, he became diſqualified for entering into holy orders. After he quitted the univerſity, he was ſecretary to the earl of Orrery; but ſeems to have ſpent the moſt of his life amongſt his friends and relations, and uſed to pay an annual viſit to his elder brother who enjoyed an eſtate of 1000l. a-year. He was a man of great tenderneſs and humanity, enjoyed the faireſt reputation, and was much eſteemed by Mr Pope; who, when he died in 1730, paid him the tribute of a very elegant epitaph. He publiſhed a volume of poems in the year 1717; and in 1723 was acted his tragedy of Mariamne, built upon her ſtory collected from Joſephus in the third volume of the Spectator.

Fenugreek || Feodal Syſtem.

FENUGREEK. See Trigonella, Botany *Index*.

FEOD, or Feud, is defined to be a right which a vaſſal hath in lands or ſome immoveable thing of his lord's, to uſe the fame,. and take the profits thereof hereditarily, rendering unto the lord ſuch feodal duties and ſervices as belong to military tenure, &c. and the propriety of the ſoil always remaining to the lord.

FEODAL, of or belonging to a Feud or Fee.

Feodal Syſtem, the conſtitution of Fiefs or Feuds. About 12 centuries ago, this ſyſtem was ſo univerſally received in Europe, that Sir Henry Spelman calls it *the law of nations in our weſtern world*. Hence it deſerves our attention in a particular manner; a knowledge of the different feuds being indiſpenſably requiſite for a proper underſtanding either of the civil government of our own country, or of the laws by which its landed property is regulated.

Origin of feuds.

The military policy of the Celtic or northern nations, known by the names of *Goths*, *Vandals*, *Franks*, *Huns*, and *Lombards*, furniſhed the original conſtitution or ſyſtem of feuds. Theſe people pouring out in vaſt multitudes from the ſame *officina gentium* or "ſtore-houſe of nations," overran all the European countries on the declenſion of the Roman empire. They brought the feudal ſyſtem along with them from the countries out of which they emigrated; and, ſuppoſing it to be the moſt proper method of ſecuring their new conqueſts, they introduced it into their more ſoutherly colonies.

According to this ſyſtem, the victorious general alloted conſiderable tracts of land to his principal officers; while they, in like manner, divided their poſſeſſions among the inferior officers, and even thoſe common ſoldiers who were thought to be the moſt deſerving. Allotments of this kind were named *feoda*, *fiefs*, *fees*, or *feuds*, from a combination of words, in the language of theſe barbarians, ſignifying a reward or ſtipend beſtowed on certain conditions (A). The condition upon which theſe rewards were given was, that the poſſeſſors ſhould faithfully ſerve the perſon from whom they were received, both at home and abroad, in the military way. To this they engaged themſelves by a *juramentum fidelitatis*, or oath of fealty †; in the event of a breach of which, either by not performing the ſervice

† See the article Feodal Tenure.

(A) We were informed by Pontopiddan, that odh in theſe northern languages is the ſame with *proprietas*, and all. with *totum* in the Latin. Hence among the northern nations, he tells us, that odhall ſignifies *right*; and hence we may conjecture that the udal right in Finland is derived ‡. By tranſpoſing theſe two northern ſyllables,

‡ See *Macdowall's Inſtit.* part 2.

Feodal System.

service agreed upon, by deserting their lord in time of battle, &c. the lands were to return to their original possessor.

2 General nature of the feodal association.

Thus the possessors of feodal allotments became interested in the defence of them; and not only the receivers but those who gave them, were equally and mutually bound to defend their possessions, none of them being able to pretend any right but that of conquest. For this purpose government and subordination were absolutely necessary; it being impossible to conduct any system of defence where every thing was tumultuous and irregular. Every person, therefore, who was a feudatory, i. e. who had received lands, was bound to do every thing in his power to defend the lord of his fee; while, on the other hand, the latter was no less subordinate to his immediate superior; and so on to the prince himself. In like manner a reciprocal bond of defence existed down from the prince to the lowest feodists.

Such were the foundations on which the feodal system was properly established; and the natural consequence was, a military subjection throughout the whole community. The prince could always collect an army of feudatories ready to defend not only the kingdom in general, but the particular possessions of each person; and the propriety of this constitution was soon apparent in the strength which these newly erected kingdoms acquired, and the valour with which their conquests were defended.

3 Of allodiality.

Besides these feodal grants, however, which were held only on the terms of military service above mentioned, there were others called *allodial*, which were given upon more enlarged principles. To these every free man had a title; and could not only claim his territory as well as the rest, but dispose of it at his pleasure (B); and this freedom was denominated *allodiality*. These allodials, however, were not exempted from military service. A part of their freedom consisted in liberty to go to the wars; for this, in the barbarous times we speak of, was the only way to acquire any degree of renown. Only the slaves were destined to follow the arts of peace; while every free person was not only at liberty to defend his country, but under an obligation to do it in case of any urgent necessity. Feodal System.

4 Feodal and national militia.

Thus there was a feodal and a national militia. The free people only were allowed to possess property; the *feudal vassals* constituted the army, properly so called; while the national militia was composed of the allodial proprietors. This allodiality, however, was not confined to landed property, but included likewise moveable estates or money; so that proprietors of the latter kind were obliged also in times of danger to bear arms and appear in the field. Between the feodal and allodial proprietors, however, there was this farther difference, that the latter had no concern with any private quarrels which might take place among the lords themselves; so that they were never obliged to appear in the field unless when called forth by the sovereign against the enemies of the nation at large. This circumstance we might suppose to be an advantage, but it ultimately operated otherwise; becoming the means of changing the allodial right into a feodal tenure. For some time the holders of fiefs had an eminent advantage over the allodial proprietors. This was owing to the imperfection of government in those days; so that the nobles had it in their power to revenge their own quarrels, while the weak were equally exposed to the insults of both parties. The lord and his vassals therefore were always formidable; but the

5 Different situations of the feodal and of the allodial proprietor.

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syllables, we form the word ALLODH; whence we have the etymology of the *allodium* or *absolute* property, claimed by the holders of fiefs or feuds; and by combining ODH, signifying "property," with the word *fee*, signifying "a conditional stipend or reward," we have the word FEODH, signifying "a property given by way of stipend or reward upon a certain condition."

(B) The author of A View of Society in Europe, has traced the remote sources of the feodal laws in an elegant and spirited manner (book i. chap. ii. sect. i.) Tacitus informs us, that the individuals of each of the German nations cultivated by turns a tract of land proportionable to their number, for the use of the whole; after which each individual received such an allotment of the cultivated tract as his dignity seemed to require. These nations had not altered their political principles at the time they overran the Roman empire; and hence the provinces of it were then divided after the same manner. The most considerable allotment was bestowed on the king, as being the most dignified person in the community, and this allotment was styled his *domain;* while the shares of citizens and warriors, which were likewise in proportion to the merit or dignity of each, constituted what was called *allodiality*. But as it often happened that all the land was not exhausted by these partitions, what remained was considered as the property of the community, and in the barbaric codes was called the *lands of the fisc*. In such German nations as had thus obtained a settlement, it was necessary that there should be a more close connexion betwixt the sovereign and the chiefs, as well as between the chiefs and people than in others. This was effected by means of the lands of the *fisc;* for of these the sovereign took possession, dealing them out to the chiefs under the burden of appearing in arms whenever he should please to call; while the chiefs in like manner dealt out lands to those called their *retainers*, who were also obliged to supply them with military assistance in cases of necessity. Hence a political system was founded, which had a prodigious effect on society in all those countries where it prevailed. The intention and tendency of this system was to render the nation independent both at home and abroad; for, while the people were all armed in their common defence, individuals were also properly guarded against the attacks of despotism. The power of the chiefs, who formed a regular nobility, was a counterpoise to that of the sovereign; while the number of the retainers and vassals, constituting the greatness and power of the nobility, was a proper barrier against aristocratical oppression; for a chief who oppressed his vassals evidently acted against his own interest.

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allodial proprietors had ſcarce any means of defending themſelves. The reaſon of this was, in the firſt place, that the law did not allow them to commit any hoſtilities; and in the next, they were too diſtant and unconnected to form any proper league for mutual defence; and hence proceeded the neceſſity already hinted at, of converting allodial property into feudal tenure. This was indeed owing in a great meaſure to the abſurdity and violence of the times, by which gifts of property, burdened with ſervice, and which might return to the perſon who granted them, were rendered ſuperior in value to the abſolute and unconditional poſſeſſion of a ſubject. Other conſiderations, however, beſides that juſt mentioned, contributed to produce the ſame effect. As in thoſe dark ages no right exiſted but what had its origin in conqueſt, it thence followed, that the greateſt conqueror or warrior was the moſt honourable perſon. The king, in whom the whole exploits of the community centered, as being their head, was the moſt honourable perſon: all others derived from him that portion of honour which they enjoyed, and which was moſt nicely adjuſted in proportion as they approached him. Allodial proprietors, therefore, having no pretenſions of this kind, were treated with contempt as a kind of poltroons. From this diſagreeable ſituation they wiſhed to free themſelves, by converting their allodial property into feodal tenures; while the princes, ſuppoſing it their intereſt to extend thoſe tenures as much as poſſible, diſcouraged the allodial poſſeſſions. As the feodiſts ſupported the importance of the nation and dignity of the monarch, it was not thought proper to allow the allodial proprietors any greater compenſations than what were given to vaſſals in ſimilar caſes. Thus they were expoſed to continual mortifications in the courts of juſtice: they were neglected by the king; denied ſufficient protection from the laws; expoſed not only to continual inſults; but to have their property on all occaſions deſtroyed by the great: ſo that they were without reſource except from the feodal tenures, and were obliged even to ſolicit the privileges which were beſtowed in other caſes on vaſſals. In theſe unhappy circumſtances, they were glad to yield up their lands to any ſuperior whom they thought moſt agreeable, and to receive them back from him as a feudal gift. Thus the landed property was everywhere changed into feudal tenures, and fiefs became univerſal (c).

Feodal Syſtem. 6 Converſion of allodium into tenure.

For ſome time the feodal ſyſtem was not only uſeful in itſelf, but honourable in its principles; but this continued no longer than while the importers of it into Europe adhered to their original ſimple and noble maxims. During that period, the lord exerciſed his bounty

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(c) It has been an object of inquiry to the learned, in what nation of barbarians fiefs had their origin? But it is probable, that they took place in all theſe nations nearly about the ſame time, on the ſame principles; and were continued by reaſon of a ſimilarity of manners, conqueſts, &c. ſo that we cannot aſcribe the prevalence of them to imitation.

In France, we find mention made of fiefs as early as the age of Childebert. They were introduced into Italy by the Lombards; amongſt whom the cuſtoms and laws relating to fiefs ſeem very early to have made rapid advances *. They were introduced into Spain before the invaſion of the Moors and Saracens in the year 710. Lands were granted for ſervice and attachment among the Goths; among whom alſo the perſon who received the gift was the retainer of him who granted it. If he refuſed his ſervice, the grant was forfeited, and he was ſaid to receive it *in patrocinio*; he alſo ſwore fealty to his lord; and on this footing the national militia was regulated †. There can be very little doubt that the feodal law was known in England in the Saxon times, as is mentioned in the text ‡. In Scotland, however, the hiſtory of fiefs is ſtill more uncertain than anywhere elſe; which has been aſcribed partly to the mutilated ſtate of the Scottiſh records, and partly to the want of able antiquaries in the nation. But, according to a late writer ||, allodiality and feudality have exiſted ever ſince the foundation of the Scottiſh monarchy, and have moſt probably ariſen from a ſimilarity of the manners and cuſtoms in Scotland to thoſe of other nations. It has indeed been ſuppoſed, that theſe cuſtoms were introduced from ſome foreign model by Malcolm II. According to ſome, they were introduced directly from England; and the policy of Malcolm in eſtabliſhing them has been highly extolled: but, according to our author, there is no foundation for any notion of that kind. Both the opinions juſt mentioned either directly aſſert or imply, that the feudal maxims were introduced into this country upon the principle of imitation; but it is very improbable that they could be imported from one people to another, on account of their exceſſive contrariety to the common uſages and precepts of government among mankind. It muſt undoubtedly have been very abſurd, if not altogether impracticable, to tranſplant the feudal tenures when the grants of land were precarious, or depending entirely on the will of the prince, to a country which had never known ſuperiority or vaſſalage. This would have required an alteration of all the orders of ſociety from the king to the peaſant; while the whole chain of cuſtoms, as well as the juriſdiction of the kingdom, both high and low, muſt have ſuſtained a correſponding alteration, in order to conform them to the new ſyſtem. It is likewiſe obvious, that no conqueſt could be made on purpoſe to obtain a ſettlement by any nation who had already received the knowledge of fiefs. The eſtabliſhment of them implied, that the people had already a fixed and ſettled reſidence; and accordingly hiſtory does not furniſh us with any account of a nation among whom fiefs were known, who ever migrated from the country they already poſſeſſed, to ſeek for one in which they might ſettle. Feudal inſtitutions muſt have originated wherever they have been obſerved to flouriſh.—Scotland was formerly a feudal kingdom, and we know pretty nearly the time when the fiefs were hereditary there; but in that form they could not be introduced by the ſovereign; and there was not any nation among whom fiefs were already known who conquered, or made an eſtabliſhment by conqueſt, in Scotland. Fiefs therefore muſt have *gradually* advanced to ſuch a ſtate of perfection. The progreſs they made may be likewiſe eaſily

* *Giannone Hiſt. of Naples*, book iv. ſect. 3.
† *L.L. Wiſigoth*, l.b. v. tit. 3. l. b. iv. tit. 7. l. xx.
‡ See alſo *Whitaker's Hiſt of Manchester.*
|| *Stuart's Obſervat. on the Law and Conſtitution of Scotland.*

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bounty to the vaſſal, which the latter repaid by acts of gratitude; ſo that the intercourſe betwixt them was of the moſt tender and affectionate kind; and this gave riſe to what are called the *feodal incidents*.

7 The feodal incidents.

The expectants of fiefs were educated in the hall of the ſuperior, while the tenures were precarious or only for life: and even when they became hereditary, the lord took care of the ſon and eſtate of his deceaſed vaſſal; not only protecting his perſon, but taking charge of his education, and directing the management of his affairs. He took pleaſure in obſerving his approach to maturity; and when he came of age, never failed to deliver to him the lands, with the care of which he had been intruſted, and which he had been careful to improve. This was called the *incident of wardſhip*.

The incident of *relief* was founded upon the gratitude of the vaſſal; who, upon entering on his fief, brought a preſent to his lord, as an acknowledgment of his care of him during the early part of his life, and in order to conciliate his future regard.

The incident of *marriage* proceeded alſo upon the principle of gratitude on the part of the vaſſal. The latter, conſcious of the favours he had received, did not chooſe to ally himſelf with a family inimical to his chief; while the ſuperior himſelf, ambitious to aggrandize and augment the importance of his family, ſought how to find the moſt advantageous match for his vaſſal.

Sometimes the ſuperior himſelf was reduced in his circumſtances by war or other accident: but from whatever cauſe his diſtreſs proceeded, even though it had ariſen from his own extravagance or prodigality, or when only deſtitute of means to ſupport his ambition or grandeur, his vaſſals were bound to ſupport and relieve him according to their circumſtances; and this was called the *incident of aid*.

The incident of *eſcheat* took place on the part of the vaſſal, when, through cowardice, treachery, or any remarkable miſbehaviour, he rendered himſelf unworthy of his fief. In that caſe, the taking it from him, and giving it to one more worthy, was called an *eſcheat*.

8 Happineſs of the feodal aſſociation.

While the lords and vaſſals thus vied with one another in mutual acts of friendſhip and benevolence, univerſal happineſs, liberty, and activity, were diffuſed through the ſociety. The vaſſals behaved courteouſly towards the retainers, who were immediately below them; while they again were courted by the lords as conſtituting their importance and ſtrength; the lords, laſtly, giving a like importance and dignity to the ſovereign himſelf. Thus a regular, powerful, and compact ſyſtem of government took place; an unanimity and attention pervaded the various departments of ſtate; ſo that, while the ſubjects were free, the nation at large was formidable.

During this happy ſtate of affairs, the members of the national aſſembly in every country in Europe appeared there in arms, whether they came perſonally or by their repreſentatives. Such particularly was the caſe under the Anglo-Saxon government; and the happineſs they at that time enjoyed made the oppreſſion and tyranny of the Normans appear the more intolerable. In proceſs of time, however, the ſtate of ſociety began to ſuffer a remarkable alteration. The high and diſintereſted notions, from which the happineſs above mentioned took its origin, declined; the romantic ideas of chivalry † ceaſed; and much more intereſted notions of property came in their ſtead. The ſeparation of the intereſts of the lords from their vaſſals was the firſt ſtep towards the deſtruction of the feodal ſyſtem. Thus the *incidents*, which, as has juſt now been mentioned, promoted their happineſs, did the very reverſe. Property being now looked upon as a diſtinction ſuperior to perſonal merit, naturally introduced the moſt mercenary views. In conſequence of theſe the infant *ward*, the care of whom was wont to be conſidered as a ſacred and honorary truſt, was now only looked upon as a mean of procuring emolument to the ſuperior. The latter now regarded the profits of his vaſſals as ſo many diminutions of his own wealth. Inſtead of taking care to improve the eſtate of his ward as formerly, he impoveriſhed it; not only neglecting the education of the heir, but offering inſults to himſelf; inſomuch that the relations of the unfortunate vaſſal were frequently obliged to ranſom from the avaricious ſuperior both his perſon and effects. By merchandiſe of this kind the coffers of princes were filled, and wardſhips let out to ſtrangers, who might exerciſe their rapacity with greater freedom. When the vaſſal at laſt attained the years of maturity, he came to the poſſeſſion of his land without any of that joy and feſtivity which uſually took place on the occaſion. He received an inheritance waſted and deſtroyed, while new grievances daily preſented themſelves to augment the horrors of his ſituation. All the *incidents*, which in former times were ſo many expreſſions of gratitude on the part of the vaſſal, were now changed into taxes which might be exacted at the pleaſure of the lord. Before the vaſſal was inveſted in his land, the ſuperior exacted from him a certain ſum or other gift, to be meaſured only by his own rapacity; and in caſe of delay or inability to pay this demand, the ſuperior continued in poſſeſſion of the eſtate. Such ſcandalous oppreſſion could not but produce the greateſt diſcontent and clamour. Applications were made to the law without ſucceſs; nor were even the laws regarded which were fabricated on purpoſe for their relief. The incident of *marriage* now proved a ſource of the moſt dreadful oppreſſion. The lord aſſumed a right of marrying his vaſſal to whom he pleaſed; and he not only exerted this right himſelf, but would ſell it to a ſtranger, or allow the vaſſal to buy it himſelf; while the penalty annexed to a marriage without

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9 Its declenſion.

† See *Chivalry* and *Knights*.

10 The perverſion of its incidents.

11 Oppreſſed ſituation of the vaſſals:

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eaſily pointed out. At firſt they were precarious, or at the pleaſure of the lord; afterwards they were granted for life; then for a courſe of years longer than the natural life of a man; and, laſtly, they became hereditary, which was their moſt perfect ſtage. This progreſs has been obſerved in every country where feodal tenures exiſt; and the ſame muſt have been known in Scotland, though, in conſidering it, we are neceſſarily carried back to periods of remote antiquity; for as fiefs were hereditary as early as the time of Malcolm II. they muſt have been in their precarious ſtate ſeveral centuries before.

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out the conſent of the ſuperior involved no leſs puniſhment than the loſs of the eſtate itſelf, or ſome grievous infliction as for a crime of the firſt magnitude. The caſe was ſtill worſe with the female ward; whoſe beauty and accompliſhments became a ſource of gain to the ſuperior, or were ſacrificed to pleaſe his whim or caprice; ſo that her relations were frequently obliged to buy from him the privilege of marrying her to the perſon ſhe or they thought moſt proper. In like manner the *aid*, which was formerly a voluntary gift from the vaſſal in caſes of diſtreſs happening to his lord, now became an unavoidable tax. An aid formerly was demanded when the eldeſt daughter of the ſuperior was married, when his eldeſt ſon was knighted, or when the ſuperior himſelf was taken priſoner in battle. Theſe were the only legal cauſes of making a demand of this kind; but in the ſubſequent times of degeneracy, the moſt frivolous pretences were every day made uſe of by the prince to oppreſs the lords, and by the lords to oppreſs their vaſſals; demanding ſubſidies at pleaſure, which their inferiors were always obliged to comply with. Laſtly, The *eſcheat*, which in former times took place only in caſes of cowardice, treachery, or ſome other heinous crime, was now inflicted on the moſt trifling occaſions. If the vaſſal happened to be too long in attending the court of his ſuperior to take the oath of fealty; if he committed any action which could in the leaſt be conſtrued an infringement of the oath; if he neglected to give his lord warning of any misfortune which he might ſuppoſe was about to befal him; revealed any thing concerning him; made love to his ſiſter or daughter, &c.; or even if he ſhould grant a tenure of land to another perſon in form different from that in which he held his own; all theſe, nay others ſtill more ridiculous, were judged ſufficient reaſons for the ſuperior to ſeize on the eſtate of the vaſſal, and involve him and his family in ruin.

12 Conſequent degeneracy of the feodal militia.

Notwithſtanding theſe oppreſſions, however, the vaſſal was ſtill obliged to ſubmit to his lord; to own him as his ſuperior; and even, in appearance, to pay him the ſame reſpect as formerly when the greateſt unanimity and cordial affection ſubſiſted between them. Still he was obliged to perform the ſame military ſervice: becauſe a failure in that reſpect would have ſubjected him to a forfeiture of lands according to the original agreement. A vaſt difference, however, now took place in the valour and activity which inſpired the army. The vaſſals, forced into the field with deſponding hearts, were indifferent as to the ſucceſs of the cauſe in which they were engaged, and frequently obſtructed inſtead of forwarding the operations of the field. Hence the ſovereign found himſelf embarraſſed; and, though nominally at the head of a martial and powerful people, was frequently unable to effect any thing, by reaſon of the mutual hatred and diſſenſion which everywhere prevailed.

13 Expedient for its recovery.

Thus the feodal ſtates of Europe became unnaturally weak: a remedy was neceſſary; and it is remarkable that the ſame remedy was applied all over the continent. This was, in ſhort, the making fiefs hereditary, which till now had only been granted for a long term of years; and, in return, burdening the lands with a certain number of ſoldiers, which were not to be refuſed upon any pretence whatever. Hence was derived the tenure of *knight-ſervice*. A certain portion of land, burdened with the ſervice of one ſoldier or knight, was called a *knight's fee*; and thus an eſtate, furniſhing any number of ſoldiers, was ſaid to contain as many knight's fees; ſo that now the manors, baronies, &c. became powerful according to the number of ſoldiers they were bound to furniſh. In the grants from the crown, the nobility were obliged to furniſh a certain number of ſoldiers for the ſervice of the ſovereign; and in thoſe from the nobility to their vaſſals, the like ſervice was required. Even the commons who had grants from the crown furniſhed a certain proportion of knights. The force of the nation was called into action by grants *in capite*, or from the ſovereign and nobility. A numerous and powerful army was inſtantly aſſembled, and at once ready for action. Of this army the king was the general, the nobility the officers, and the vaſſals ſoldiers; the whole being exactly arranged, and capable of entering upon any expedition without the leaſt delay.

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14 Invention of knight-ſervice.

Thus a remedy was found in ſome meaſure for the weakneſs of the feodal ſovereigns: but though the knights tenure could accompliſh this, it could not bring back the former affection and cordiality which ſubſiſted between the various ranks of people. On the contrary, by uniting them more firmly to one another by legal ties, it rendered matters rather worſe. The oppreſſion originating from the operation of the feodal *incidents*, ſtill continued with unremitting violence. The grants of knights tenure were attended with the ſame oaths of homage and fealty; the ſame incidents of relief, wardſhip, marriage, aid, and eſcheat, with the feodal tenures. The princes promiſed to abate ſomewhat of their rigour in demanding the feodal perquiſites, but did not keep their word. Laws were occaſionally promulgated, and for ſome time had an effect; but palliatives ſoon became ineffectual, and a new ſtate of weakneſs began to commence.

15 Two eras in the hiſtory of fiefs.

The two remarkable eras in the feodal hiſtory are, the time before the invention of knight-ſervice (D), and that during which it continued. Fiefs were in a ſtate of fluctuation from the deſtruction of the Roman empire till the ninth century; but they were rendered perpetual in France about the year 877, and were generally become ſo in every country of Europe about the beginning of the tenth. Du Cange, *voce Militia*, gives us an example of a knight fee in the year 880. By the year 987, when Hugh Capet was raiſed to the throne of France, knight ſervice was become general all over Europe, and was introduced into England after having made its appearance in other countries (E). In England, however, there have been ſeveral doubts and inquiries

16 Doubts concerning the introduction of the feodal law into England.

(D) For the difference between the knights produced by this ſervice and the more ancient ones, or knights of honour, ſee the article KNIGHT.

(E) Dr Stuart informs us, that it appears from the records of Malcolm IV. in 1153, that knights-ſervice was

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quiries among the learned concerning the introduction of the feodal laws. Many are of opinion, that they were firſt introduced by William the Conqueror; and, conſequently, that they were entirely unknown to the Anglo-Saxons: but others think, that they exiſted among the latter in the ſame form under which they were continued by the Normans. Dr Stuart is of opinion that the Saxons who ſettled in England could not be ſtrangers to fiefs. He ſuppoſes the conformity of manners, which undoubtedly prevailed between the Saxons and other barbarians, a ſufficient proof that the hereditary grant of land, as well as the fluctuating ſtate of feodal tenures which preceded it, were known to the former. Collateral proofs are derived from the ſpirit and tenure of the Anglo-Saxon laws, but eſpecially from the grants of hereditary eſtates on condition of military ſervice (F). The condition of fiefs under the Anglo-Saxons was very different from what it was afterwards. In their times we find no mention made of theſe oppreſſions of which ſo much notice has already been taken; and this may eaſily be accounted for from the alteration of the feodal ſpirit in different ages. During the time that a warm and generous affection ſubſiſted between the feodal ſuperiors and vaſſals, the incidents were marks of generoſity on the one part, and gratitude on the other; but as ſoon as a variance had taken place, by reaſon of the intereſted diſpoſition which the introduction of luxury produced, the ſame incidents became ſources of the moſt flagrant oppreſſion. This was remarkably the caſe in the time of William the Conqueror; and, during the reign of King John, matters were come to ſuch a criſis, that the people everywhere complained loudly, and demanded the reſtoration of the laws of Edward the Confeſſor (G). "What theſe laws of Edward the Confeſſor were (ſays Mr Hume), which the Engliſh every reign during a century and a half deſired ſo paſſionately to have reſtored, is much diſputed by antiquarians; and our ignorance of them ſeems one of the greateſt defects of the ancient Engliſh hiſtory." Dr Stuart has offered an explanation; but this is in fact no more than a conjecture, that "by the laws or cuſtoms of the Confeſſor, that condition of felicity was expreſſed which had been enjoyed during the fortunate ſtate of the feodal aſſociation. The cordiality, equality, and independence, which then prevailed among all ranks in ſociety, continued to be remembered in leſs proſperous times, and occaſioned an ardent deſire for the revival of thoſe laws and uſages which were the ſources of ſo much happineſs."

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17 Inſufficient ſolution of them by Dr Stuart.

18 Diſtinction concerning fiefs in the Anglo-Saxon and the Anglo-Norman times.

Beſides the great diſtinction (of which an account has already been given) between the ſtate of fiefs under the Anglo-Saxons and under the Normans, they were no leſs diſtinguiſhed by the introduction of knight-ſervice. Hitherto the refinement of the Engliſh had been obſtructed by the invaſion of the Danes, and the inſular ſituation of the kingdom; but after the Norman conqueſt the fiefs were made perpetual. Still, however, the knight-fee and knight-ſervice were altogether unknown. William, the ſixth prince who enjoyed the duchy of Normandy, was well acquainted with every thing relating to fiefs; for that duchy had experienced all the variety incidental to them from the time of its being granted to Rollo by Charles the Simple in the year 912, to the year 1066, when William was put in poſſeſſion of England by the battle of Haſtings.

On his acceſſion to the throne, a number of forfeitures took place among thoſe who had followed the fortune of Harold. Their eſtates were to be diſpoſed of at the pleaſure of the conqueror; and it was natural to ſuppoſe that he would follow the method practiſed in

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was known in Scotland, and that it was not a novelty at that time. The ſame author thinks it even probable, that it was known in the time of David I.

(F) The uſe of entails was known to the Anglo-Saxons; and this practice, as well as the ſucceſſion to allodial eſtates, muſt have contributed very much to eſtabliſh hereditary fiefs. This opinion ſeems alſo to be confirmed by the accounts we have of the great power of many of the nobility among the Anglo-Saxons, and the natural tendency that fiefs muſt have, in the courſe of things, to become perpetual, though analogical arguments cannot entirely be depended upon in this caſe. There is indeed poſitive evidence that the territory which anciently conſtituted the kingdom of Mercland belonged to Ethelred as an hereditary fief and earldom. The grant was given him by Alfred when he married his daughter Ethelfleda: and it is likewiſe atteſted by Camden, that in the time of Ethelred the earldom of Leiceſter was an inheritance, and the regular ſucceſſion of its earls is ſtill known. We are informed alſo by creditable hiſtorians, that Bernicia and Deireland were feodal and inheritable earldoms among the Saxons. The ſame was true of the county of Cumberland when poſſeſſed by the Scottiſh monarchs, This laſt appears from the Saxon Chronicle: in which the grant was conveyed by Edmund king of England to Malcolm of Scotland in the following terms: "Edmundus rex totam Cumberland prædavit et contrivit, et *commendavit* eam Malcomo regi Scotiæ; hoc pacto, quod *in auxilio* ſibi foret terra et mari." From the uſe of the word *commendavit*, indeed, Spelman takes occaſion to ſay, that a feodal homage was not intended: but the contrary may be proved by the original Saxon from which the foregoing is a Latin tranſlation; and the word, according to ſeveral learned critics, ſignifies feodal homage with the moſt ſtrict propriety. Thus Du Cange informs us, that *commendare ſe alicui* was the general expreſſion for *faire l'hommage a un ſeigneur*.

(G) The laws which are now extant under the name of Edward, are generally allowed to be of doubtful authenticity; nor are they, even ſuppoſing them to be genuine, of any uſe in anſwering the preſent queſtion. They determine indeed the exiſtence of fiefs among the Anglo-Saxons: and Dr Stuart is of opinion, that the compilation which goes under the name of this prince, though poſterior to the date it bears, nevertheleſs merits greater attention than has uſually been beſtowed upon it. M. Honard, a foreign lawyer, is the laſteſt writer who has made it his ſtudy; but he is better acquainted with the Norman than the Anglo-Saxon cuſtoms.

Feudal System.

in his own country. Hence the origin of knight ſervice in England. A grant of land, to any perſon whatever, was eſtimated at a certain number of knights fees; and each of theſe required the ſervice of a knight. The grants of lands were even renewed to the old tenants under this tenure; ſo that by degrees the whole military people in the kingdom acquieſced in it. To accompliſh this, DOMESDAY *Book*, is ſuppoſed to have been compiled, which contained an exact account of all the landed property of the kingdom.—Hence it is to be concluded, not that William introduced fiefs into England, as ſome have imagined, but that he brought them to their ultimate ſtate of perfection by the introduction of knight-ſervice. This is evident from the laws enacted during his reign. In theſe it is not only mentioned that knight-ſervice was enacted, but that it was done expreſsly with the conſent of the common council of the nation; which at that time was equivalent to an act of parliament (H).

19 Introduction of knight-ſervice into England.

The invention of knight-ſervice proved generally agreeable: for as only few of the Anglo-Saxon fiefs were hereditary, the advancement of the reſt to perpetuity, under the tenure of knight-ſervice, muſt have been accounted an acquiſition of ſome importance; as not only augmenting the grandeur and dignity of the ſovereign, but ſecuring the independence of the ſubject, and improving his property. In the happy ſtate of the feodal aſſociation, there was indeed no neceſſity for the knight's fee; but when the diſcordance and oppreſſion ſo often mentioned began to take place, it became then neceſſary to point out particularly every duty of the vaſſal, as well as of the lord; and this was fully done by the invention of knight-ſervice. The nobles poſſeſſed duchies, baronies, and earldoms; which extenſive poſſeſſions were divided into as many fees, each of them to furniſh a knight for the ſervice of the king, or of the ſuperior; ſo that every feudal ſtate could command a numerous army and militia to ſupport and defend it in caſe of any emergency. The knights were alſo bound to aſſemble in complete armour whenever the ſuperior thought proper to call, and to hold themſelves in readineſs for action whenever the king or ſuperior found it convenient to take the field: ſo that thus the militia might be marched at the ſhorteſt notice to defend or ſupport the honour of the nation.

20 Idea of the feodal militia.

The knights were uſually armed with a helmet, ſword, lance, and ſhield; and each was beſides obliged to keep a horſe. This laſt requiſite was owing to the contempt into which the infantry had fallen through the prevalence of tournaments and luxuries of various kinds, though it was by means of the infantry that the barbarians had originally diſtinguiſhed themſelves in their wars with the Romans, and became able to cope with theſe celebrated warriors. All proprietors of fees or tenants by knight-ſervice fought on foot: the cavalry were diſtinguiſhed by the name of *battle*; and the ſucceſs of every encounter was ſuppoſed to depend on them alone. They only were completely armed; the infantry, being furniſhed by the villages under the juriſdiction of the barons, had at firſt only bows and ſlings; though afterwards they were found worthy of much greater attention.

Feudal System.

While the feodal aſſociation remained in perfection, the ſuperior could at any time command the military ſervice of his vaſſals; but in the ſubſequent degeneracy this ſervice could neither be depended upon when wanted, nor was it of the ſame advantage when obtained as formerly. The invention of knight-ſervice tended in a great degree to remedy this inconvenience. Thoſe who were poſſeſſed of knights fees were now obliged to remain 40 days in the field at their own expence; and this without exception, from the great crown vaſſals to the ſmalleſt feudatories; but if longer ſervice was required, the prince was obliged to pay his troops. In thoſe times, however, when the fate of nations was frequently decided by a ſingle battle, a continuance in the field for 40 days was ſufficient for ordinary occaſions.

21 Its inefficacy and corruption.

Thus matters ſeemed once more to be reſtored nearly to their former ſtate. It was now, as much as ever, the intereſt of the nation to act with unanimity in its defence, not only againſt foreign enemies, but againſt the tyranny of the prince over his ſubjects, or of one part of the ſubjects over the other. New inconveniencies, however, ſoon began to take place, owing to the gradual improvements in life and the refinement of manners. From the firſt inſtitution of military ſervice, a fine had been accepted inſtead of actual appearance in the field. In the times of barbarity, however, when men accounted rapine and bloodſhed their only glory, there were but few who made an offer of this compenſation; but as wealth and luxury increaſed, and the manners of people became ſofter, a general unwillingneſs of following the army into the field became alſo prevalent. A new tenure, called *eſcuage*, was therefore introduced, by which the vaſſal was only obliged to pay his ſuperior a ſum of money annually, inſtead of attending him into the field *. Hence originated taxes and their miſapplication; for as the king was lord paramount of the whole kingdom, it thence happened that the whole eſcuage money collected throughout the nation centred in him. The princes then, inſtead of recruiting their armies, frequently filled their coffers with the money, or diſſipated it otherwiſe, hiring mercenaries to defend their territories when threatened with any danger. Theſe being compoſed of the dregs of the people, and diſbanded at the end

* See the particular conſequences of this under the article *Knight-Service*.

22 Riſe of ſtanding armies, &c.

(H) The following law of William the Conqueror not only makes expreſs mention of the knight's fee and ſervice, but alludes to a former law of William and his parliament, by which this tenure was actually eſtabliſhed. "Statuimus etiam et firmiter præcipimus, ut omnes comites, et barones, et milites, et ſervientes, et univerſi liberi homines totius regni noſtri prædicti, habeant et teneant ſe ſemper bene in *armis* et in *equis*, ut decet et oportet, et quod ſint ſemper prompti et bene parati ad *ſervitium ſuum integrum* nobis explendum, et peragendum, cum ſemper opus adfuerit, ſecundum quod NOBIS debent de *feodis et tenementis ſuis* de jure facere, et ſicut illis ſtatuimus per *commune conſilium* totius regni noſtri prædicti, et dedimus et conceſſimus in feodo jure hæreditario." *LL. Guill.* c. 58.

Feoffment || Feralia.

end of every campaign, filled all Europe with a disorderly banditti, who frequently proved very dangerous to ſociety. To avoid ſuch inconveniencies, ſtanding armies were introduced, and taxations began to be raiſed in every European kingdom. New inconveniencies aroſe. The ſovereigns in moſt of theſe kingdoms, having acquired the right of taxation, as well as the command of the military power, became completely deſpotic: but in England the ſovereign was deprived of this right by Magna Charta, which was extorted from him, as related under the article ENGLAND, N° [153]; ſo that, though allowed to command his armies, he could only pay them by the voluntary contributions of the people, or their ſubmitting to ſuch taxations as were virtually impoſed by themſelves.

FEOFFMENT, in *Law*, (from the verb *feoffare* or *infeudare*, "to give one a feud"); the gift or grant of any corporeal hereditament to another. He that ſo gives, or enfeoffs, is called the *feoffer*, and the perſon enfeoffed is denominated the *feoffee*.

This is plainly derived from, or is indeed itſelf the very mode of, the ancient feodal donation; for though it may be performed by the word "enfeoff," or "grant," yet the apteſt word of feoffment is *do* or *dedi*. And it is ſtill directed and governed by the ſame feodal rules; inſomuch that the principal rule relating to the extent and effect of the feodal grant, *tenor eſt qui legem dat feudo*, is in other words become the maxim of our law with relation to feoffments *modus legem dat donationi*. And therefore, as in pure feodal donations, the lord, from whom the feud moved, muſt expreſsly limit and declare the continuance or quantity of eſtate which he meant to confer, *ne quis plus donaſſe præſumatur, quam in donatione expreſſerit*; ſo, if one grants by feoffment lands or tenements to another, and limits or expreſſes no eſtate, the grantee (due ceremonies of law being performed) hath barely an eſtate for life. For, as the perſonal abilities of the feoffee were originally preſumed to be the immediate or principal inducements to the feoffment, the feoffee's eſtate ought to be confined to his perſon, and ſubſiſt only for his life; unleſs the feoffer, by expreſs proviſion in the creation and conſtitution of the eſtate, hath given it a longer continuance. Theſe expreſs proviſions are indeed generally made; for this was for ages the only conveyance, whereby our anceſtors were wont to create an eſtate in fee-ſimple, by giving the land to the feoffee, to hold to him and his heirs for ever; though it ſerves equally well to convey any other eſtate of freehold.

But by the mere words of the deed the feoffment is by no means perfected: there remains a very material ceremony to be performed, called *livery of ſeiſin*, without which the feoffee has but a mere eſtate at will. See SEISIN.

FERÆ, an order of quadrupeds, belonging to the claſs *Mammalia*. See MAMMALIA *Index*.

FERALIA, in antiquity, a feſtival obſerved among the Romans on February 21ſt, or, according to Ovid, on the 17th of that month, in honour of the manes of their deceaſed friends and relations.

Varro derives the word from *inferi*, or from *fero*; on account of a repaſt carried to the ſepulchres of ſuch as the laſt offices were that day rendered to. Feſtus derives it from *ferio*, on account of the victims ſacrificed. Voſſius obſerves, that the Romans called death *fera*, "cruel," and that the word *feralia* might ariſe thence. —Macrobius, Saturn. lib. i. cap. 13. refers the origin of the ceremony to Numa Pompilius. Ovid, in his Faſti, goes back as far as Æneas for its inſtitution. He adds, that on the ſame day a ſacrifice was performed to the goddeſs Muta, or Dumb: and that the perſons who officiated were an old woman attended with a number of young girls. Fer || Ferg.

During the continuance of this feſtival, which laſted eleven days, preſents were made at the graves of the deceaſed, marriages were forbidden, and the temples of the gods ſhut up. While the ceremonies continued, they imagined that the ghoſts ſuffered no puniſhments in hell, but that their tormentors allowed them to wander round their tombs, and feaſt upon the meats which their ſurviving friends had prepared for them.—For a more particular account of the offerings and ſacrifices and feaſts for the dead, ſee INFERIÆ and SILICERNIUM.

Sometimes at the feralia public feaſts were given to the people, at the tombs of the rich and great, by their heirs or particular friends.

FER DE FOURCHETTE, in *Heraldry*, a croſs having at each end a forked iron, like that formerly uſed by ſoldiers to reſt their muſkets on. It differs from the croſs-fourche, the ends of which turn forked; whereas this has that ſort of fork fixed upon the ſquare end. See HERALDRY.

Fer de Moulin, *Milrinde*, *Inke de Moulin*, in *Heraldry*, is a bearing ſuppoſed to repreſent the iron ink, or ink of a mill, which ſuſtains the moving millſtone.

FERDINAND V. king of Spain, called *the Catholic*, which title was continued to his ſucceſſors. He married Iſabella of Caſtile, by which that kingdom was united to the Spaniſh crown. This illuſtrious couple laid the foundation of the future glory and power of Spain. The conqueſt of Granada, and the diſcoveries of Chriſtopher Columbus, make this reign a celebrated era in the hiſtory of Spain. He died in 1516, aged 63. See (*Hiſtory of*) SPAIN.

FERENTARII, in Roman antiquity, were auxiliary troops, lightly armed; their weapons being a ſword, bow, arrows, and a ſling.

FERENTINUM, in *Ancient Geography*, a town of the Hernici in Latium, which the Romans, after ſubduing that nation, allowed to be governed by its own laws. Now *Ferentino*, an epiſcopal city in the Campagna di Roma. E. Long. 14. 5. N. Lat. 41. 45.

FERENTUM, or FORENTUM, in *Ancient Geography*, a town of Apulia in Italy. Now *Forenza*, in the Baſilicata of Naples.

FERETRIUS, a ſurname of Jupiter, *à ferendo*, becauſe he had aſſiſted the Romans: or *à feriendo*, becauſe he had conquered their enemies under Romulus. He had a temple at Rome built by Romulus. It was there that the ſpoils called *opima* were always carried.

FERETRUM, among the Romans, the bier uſed in carrying out the bodies of the dead, which duty was performed by the neareſt male relations of the deceaſed: thus, ſons carried out their parents, brothers their ſiſters, &c.

FERG, or FERGUL, FRANCIS PAUL, a charming landſcape-painter, was born at Vienna in 1689, and there learned the firſt principles of his art. He ſucceſſively

Fergus, Fergufons.

ceſſively practiſed under Hans Graf, Orient, and Thiele. This laſt, who was painter to the court of Saxony, invited him to Dreſden to inſert ſmall figures in his landſcapes. Ferg thence went into Lower Saxony, and painted for the duke of Brunſwick and for the gallery of Salzdahl. From Germany he went to London, where he might have lived in the higheſt eſteem and affluence, if, by an indiſcreet marriage, he had not been ſo effectually depreſſed, that he was ever after involved in difficulties. The neceſſities which aroſe from his domeſtic troubles compelled him to diminiſh the prices of his paintings in order to procure an immediate ſupport; and as thoſe neceſſities increaſed, his pictures were ſtill more ſunk in their price, though not in their intrinſic value. By a ſeries of misfortunes he was over-run with debts; and to avoid the purſuit of his creditors, he was conſtrained to ſecrete himſelf in different parts of London. He died ſuddenly in the ſtreet one night as he was returning from ſome friends, about the year 1738, before he had attained his 50th year; and left four children. This pleaſing artiſt, Mr Walpole obſerves, had formed a manner of his own from various Flemiſh painters, though reſembling Poelemburg moſt in the enamelled ſoftneſs and mellowneſs of his colouring; but his figures are greatly ſuperior; every part of them is ſufficiently finiſhed, every action expreſſive. He painted ſmall landſcapes, fairs, and rural meetings, with the moſt agreeable truth; his horſes and cattle are not inferior to Wouvermans; and his buildings and diſtances ſeem to owe their reſpective ſoftneſs to the intervening air, not to the pencil. More faithful to nature than Denner, he knew how to omit exactneſs, when the reſult of the whole demands a leſs preciſion in parts. The greateſt part of his works are in London and Germany; and the price they now bear is the beſt proof of their real merit. He alſo etched well with aquafortis; and his prints of that kind are greatly eſteemed by the curious.

FERGUS, the name of three kings of Scotland. See (*Hiſtory of*) SCOTLAND.

FERGUSON, JAMES, an eminent experimental philoſopher and mechanic, was born in Scotland, of very poor parents. At the earlieſt age his extraordinary genius began to exert itſelf. He firſt learned to read by overhearing his father teach his elder brother: and he had made this acquiſition before any one ſuſpected it. He ſoon diſcovered a peculiar taſte for mechanics, which firſt aroſe on ſeeing his father uſe a lever. He purſued this ſtudy a conſiderable length, even while very young; and made a watch in woodwork, from having once ſeen one. As he had no inſtructor, nor any help from books, every thing he learned had all the merit of an original diſcovery; and ſuch, with infinite joy, he believed it to be. As ſoon as his age would permit, he went to ſervice; in which he met with hardſhips, which rendered his conſtitution feeble through life. Whilſt he was ſervant to a farmer (whoſe goodneſs he acknowledges in the modeſt and humble account of himſelf which he prefixed to his laſt publication), he frequently contemplated the ſtars; and began the ſtudy of aſtronomy, by laying down, from his own obſervations only, a celeſtial globe. His kind maſter obſerving theſe marks of his ingenuity, procured him the countenance and aſſiſtance of his ſuperiors. By their help and inſtructions, he went on gaining farther knowledge, and was ſent to Edinburgh. There he began to take portraits; an employment by which he ſupported himſelf and family for ſeveral years, both in Scotland and England, whilſt he was purſuing more ſerious ſtudies. In London he firſt publiſhed ſome curious aſtronomical tables and calculations; and afterwards gave public lectures in experimental philoſophy, which he repeated (by ſubſcription) in moſt of the principal towns in England, with the higheſt marks of general approbation. He was elected a fellow of the Royal Society, without paying for admiſſion (an honour ſcarcely ever conferred on a native); and had a penſion of 50l. per ann. given him, unſolicited, by our gracious king, at his acceſſion who had heard lectures from him, and frequently ſent for and converſed with him on curious topics. He alſo received ſeveral preſents from his majeſty, the patron of real merit. To what a degree of conſideration Mr Ferguſon mounted by the ſtrength of his natural genius, almoſt every one knows. He was univerſally conſidered as at the head of aſtronomy and mechanics in this nation of philoſophers. And he might juſtly be ſtiled ſelf-taught, or rather heaven-taught; for in his whole life he had not above half a year's inſtruction at ſchool. He was a man of the cleareſt judgment and the moſt unwearied application to ſtudy; benevolent, meek, and innocent in his manners as a child; humble, courteous, and communicative; inſtead of pedantry, philoſophy ſeemed to produce in him only diffidence and urbanity,—a love for mankind and for his Maker. His whole life was an example of reſignation and Chriſtian piety. He might be ſaid to be an enthuſiaſt in his love of God, if religion, founded on ſuch ſubſtantial and enlightened grounds as his was, could be ſtyled enthuſiaſm. He died in 1776.

Ferguſon.

FERGUSON, *Robert*, a Scottiſh poet, who acquired a conſiderable ſhare of celebrity at a very early period of life, was born at Edinburgh on the 5th of September 1750, of which we are aſſured from unqueſtionable authority, although ſome have placed it in 1751. His father's name was William, who, as well as the ſon, likewiſe paid court to the muſes: but he wiſely relinquiſhed the ſtudy of poetry for the more certain emoluments of trade and commerce, being employed in different mercantile houſes both in Edinburgh and Aberdeen. He was an accountant in the Linen Hall when he died, but never acquired any thing like an independent fortune.

The ſubject of the preſent ſketch was of a weak and delicate conſtitution during infancy,—indeed to ſuch a degree, that ſmall hopes were entertained of his ever reaching the years of manhood. Yet ſuch were the care and attention of his parents, that he was able to attend an Engliſh ſchool by the time he was ſix years of age, when his progreſs was conſidered as very extraordinary. It was no leſs rapid at the high ſchool of Edinburgh, which he attended for years, acquiring a competent knowledge of the Latin tongue with very little labour or exertion. From that he went to the grammar ſchool of Dundee, and in two years after to the univerſity of St Andrews, which place his father preferred to Edinburgh, becauſe a gentleman of the name of Ferguſon had left two burſaries for the education of two boys of the ſame name.

His

Ferguſon. His health was never impaired at any time by ſevere ſtudy; yet he kept alive at the univerſity the opinion which had been entertained of him while at ſchool, and he was decidedly the firſt mathematician of the ſame ſtanding. He was patronized by Dr Wilkie, profeſſor of natural philoſophy, who was perhaps as much attached to him for his poetical as his mathematical talents, the doctor himſelf being a poet, and author of the Epigoniad. This kindneſs was repaid by Ferguſon, on the death of Dr Wilkie, by a beautiful eclogue to his memory, written in the Scottiſh dialect. A little before he left the univerſity, Ferguſon had conceived the idea of writing a tragedy on the death of Sir William Wallace, for which he had collected materials; but as he afterwards met with a work on the ſame ſubject, he abandoned the deſign, after he had completed two acts. His own reaſon for doing ſo he thus expreſſed. "Whatever I publiſh ſhall be original, and this tragedy might be conſidered as a copy."

He returned to Edinburgh when he had finiſhed his ſtudies, without having fixed on any particular employment; for although he was deſtined for the church by his father, on his death he paid little attention to the expoſtulations of his mother. He declined alſo the ſtudy of phyſic, aſſigning this as a reaſon, that when he read the deſcription of diſeaſes, he believed that he felt the ſymptoms of them all in himſelf. He was then induced to attempt the ſtudy of the law, in which, as was natural to expect, he made no proficiency. He ſeems to have turned a wiſhful eye to ſome ſinecure place, to obtain which he paid a viſit to an uncle who reſided at Aberdeen, a man of literature and opulence, hoping that through his influence he might be ſettled in ſome place ſuited to his merit. In this rational hope he was completely diſappointed; for although his uncle ſhewed him every mark of attachment, his fondneſs decayed by degrees, and in ſix months he deſired him in an abrupt manner to leave his houſe, without attempting to procure for him any kind of living. It would perhaps be raſh and uncandid to reprobate this conduct of his uncle, whoſe penetration probably beheld, if not the actual commiſſion, at leaſt the germinating ſeeds of thoſe too faſhionable vices and follies into which he afterwards plunged. We only give this as a conjecture of our own; but it ſeems to derive conſiderable countenance from the contraſt between the manner in which his uncle received him, and the nature of their ſeparation. Be this as it may, the conduct of his uncle operated powerfully on the mind of Ferguſon, which, with the fatigue of his journey back to Edinburgh, brought on him a ſevere illneſs, on his recovery from which he compoſed two elegies; one on the decay of friendſhip, and the other againſt repining at fortune; both which were ſuggeſted by this adventure at Aberdeen. The diſappointment of his hopes, and the effect it produced on his mind, are very evident from the following ſtanzas.

But, ah! theſe youthful ſportive hours are fled,
Theſe ſcenes of jocund mirth are now no more;
No healing ſlumbers 'tend my humble bed,
No friends condole the ſorrows of the poor.

And what avail the thoughts of former joys?
What comfort bring they in the adverſe hour?
Can they the canker-worm of care deſtroy
Or brighten fortune's diſcontented lour?

So great were his neceſſities at this period, that he copied papers in the commiſſary clerk's office for ſo much per ſheet, which employment he ſoon left in diſguſt. Ferguſon, Feriæ.

So boundleſs was his wit, which was only equalled by his good nature, modeſty, and goodneſs of heart, that all who knew him received him with affection; but his powers of ſong and talents for mimicry often led him into the company of the diſſipated, whoſe example could not fail of doing him eſſential injury, but who had neither the power nor inclination to provide for him through life. The irregularities into which he was thus frequently led, often awakened upon him the dictates of conſcience; and the converſation of a miniſter who underſtood his manner of life, made a deep impreſſion on his mind. In ſhort, his remorſe ſoon after aſſumed the appearance of abſolute deſpair. His ſprightlineſs entirely forſook him; but he gradually recovered from his deſpondency, and his health was fully reſtored. Soon after he cut his head ſo dreadfully in conſequence of a fall, that from the loſs of blood he became delirious, in which condition he remained for ſome months, till the want of ſleep and perpetual talking put a period to his exiſtence on the 16th of October 1774. He was buried in the Canongate churchyard; over his grave his admirer Robert Burns has ſince erected a monument.

Had he joined prudence to his bright genius and good heart, he would have no doubt riſen to diſtinguiſhed eminence in the literary world. His poems in the Scottiſh dialect have been univerſally admired by his countrymen; and when we reflect that they were compoſed in a round of diſſipation, they muſt be conſidered as unequivocal evidences of his genius and taſte.

FERIÆ, in Roman antiquity, holidays, or days upon which they abſtained from work. Proclamation was generally made by the herald, by command of the *Rex Sacrorum* or *Flamines*, that all ſhould abſtain from buſineſs; and whoever tranſgreſſed the order was ſeverely fined.—The feriæ were of two kinds, public and private.

The *public* feriæ were fourfold. 1. *Stativæ*, which were kept as public feaſts by the whole city upon certain immoveable days appointed by their kalendar;—ſuch were the *Compitalia*, *Carmentalia*, *Lupercalia*, &c. 2. *Feriæ Conceptivæ*, which were moveable feaſts, the days for the celebration of which were fixed by the magiſtrates or prieſts; of this ſort were the *Feriæ Latinæ*, *Paganalia*, *Compitalia*, &c. which happened every year, but the days for keeping them were left to the diſcretion of the magiſtrates or prieſts. 3. *Feriæ Imperativæ*, which were fixed and inſtituted by the mere command of conſuls, prætors, dictators, upon the gaining of ſome victory or other fortunate event. 4. *Nundinæ*. See the articles NUNDINÆ, AGONALIA, CARMENTALIA, &c.

The *private* feriæ were holidays obſerved by particular perſons or families on ſeveral accounts, as birthdays, funerals, &c. The feriæ belonged to, and were one diviſion of the *dies feſti*. See FESTI.

Feriæ Latinæ, a feſtival at which a white bull was ſacrificed, and the Latin and Roman towns provided each a ſet quantity of meat, wine, and fruits; and during the celebration, the Romans and Latins ſwore

Feria ‖ Fermanagh.

eternal friendſhip to each other, taking home a piece of the victim to every town. The feſtival was inſtituted by Tarquinius Superbus when he overcame the Tuſcans and made a league with the Latins, propoſing to build a common temple to Jupiter Latialis, at which both nations might meet and offer ſacrifices for their common ſafety. At firſt the ſolemnity laſted but one day, but it was at different times extended to ten. It was held on the Alban mount, and celebrated with chariot races at the Capitol, where the victor was treated with a large draught of wormwood drink.

FERIA, in the Romiſh breviary, is applied to the ſeveral days of the week; thus Monday is the *feria ſecunda*, Tueſday the *feria tertia*; though theſe days are not working days, but holidays. The occaſion of this was, that the firſt Chriſtians were uſed to keep the Eaſter week holy, calling Sunday the *prima feria*, &c. whence the term *feria* was given to the days of every week. But beſides theſe, they have extraordinary feriæ, viz. the three laſt days of Paſſion week, the two following Eaſter day, and the ſecond feriæ of Rogation.

FERIANA, the ancient city of Thala in Africa, taken and deſtroyed by Metellus in the war with Jugurtha. It was viſited by Mr Bruce in his late travels through Africa, who expected to have found many magnificent ruins in the place, but was diſappointed. The only remarkable objects he met with were the baths, which are exceſſively warm. Theſe are without the town, and flow from a fountain named *El Tarmid*. Notwithſtanding the exceſſive heat of its water, the fountain is not deſtitute of fiſhes. They are of the ſhape of a gudgeon, above four inches in length; and he ſuppoſed that there might have been about five or ſix dozen of them in the pool. On trying the water with a thermometer, he found the heat ſo great, that he was ſurpriſed the fiſh were not boiled in it. That fiſh ſhould exiſt in this degree of heat, is very ſurpriſing; but it ſeems no leſs wonderful that Mr Bruce, while ſtanding naked in ſuch water, ſhould leiſurely make obſervations on its heat, without ſuſpecting that he himſelf would be boiled by continuing there. We have to regret that the accidental wetting of the leaf on which he wrote down his remarks has deprived the public of the knowledge of the preciſe degree to which the thermometer is raiſed by this water. The fiſh are ſaid to go down the ſtream to ſome diſtance during the day, and to return to the ſpring or warmeſt part at night.

FERMANAGH, a county of Ireland, in the province of Ulſter; bounded by Cavan on the ſouth, Tir-Oen on the north and north-eaſt, by Tyrconnel on the north-weſt, Leitrim on the ſouth-weſt, and Monaghan on the weſt. It is 38 miles long and 24 broad. A great part of it is taken up with bogs; and the great lake called *Lough-Earne*, which is near 20 miles in length and in ſome places 14 in breadth, diverſified with upwards of 300 iſlands, moſt of them well wooded, inhabited, and covered with cattle. It abounds alſo with great variety of fiſh, ſuch as huge pike, large bream, roach, eels, trout, and ſalmon. The water of the lake in ſome places is ſaid to have a particular ſoftneſs and ſliminеſs, that bleaches linen much ſooner than could be done by other water. The lake is divided into the upper and lower, between which it contracts itſelf for five or ſix miles to the breadth of an ordinary river. In one part of the county are marble rocks 50 or 60 feet high. This county formerly ſent four members the Iriſh parliament, viz. two for the ſhire, and two for Inniſkillen the capital. Fermanagh gives the title of viſcount to Earl Verney.

Ferment, Fermentation.

FERMENT, any body which being applied to another, produces fermentation.

Ferments are either matters already in the act of fermentation, or that ſoon run into this act. Of the firſt kind are the flowers of wine, yeaſt, fermenting beer, or fermenting wine, &c. and of the ſecond are the new expreſſed vegetable juices of ſummer fruit.

Among diſtillers, ferments are all thoſe bodies which, when added to the liquor, only correct ſome fault therein, and, by removing ſome obſtacle to fermentation, forward it by ſecondary means: as alſo ſuch as, being added in time of fermentation, make the liquor yield a larger proportion of ſpirit, and give it a finer flavour.

FERMENTATION, may be defined a ſenſible internal motion of the conſtituent particles of a moiſt, fluid, mixed or compound body; by the continuance of which motion, theſe particles are gradually removed from their former ſituation or combination, and again, after ſome viſible ſeparation is made, joined together in a different order and arrangement, ſo that a new compound is formed, having qualities very ſenſibly different from thoſe of the original fluid.

Fermentation, properly ſo called, is confined to the vegetable and animal kingdoms; for the effervеſcences between acids and alkalies, however much they may reſemble the fermentation of vinous liquors, are nevertheleſs exceedingly different. It is divided into three kinds; or rather, there are three different ſtages of it, viz. the vinous, the acetous, and the putrefactive. To theſe has been added a fourth, the *panary*, or the fermentation of bread. Of the firſt, vegetables alone are ſuſceptible; the fleſh of young animals is in ſome ſlight degree ſuſceptible of the ſecond (A); but animal ſubſtances are particularly ſuſceptible of the third, which vegetables do not ſo eaſily fall into without previouſly undergoing the firſt and ſecond. The produce of the firſt ſtage is wine, or ſome other vinous liquor; of the ſecond, vinegar; and of the third, ammonia or volatile alkali.

(A) Under the article CHINA, N° 115. a fact is mentioned which ſeems to ſhow that animal ſubſtances are likewiſe capable of the vinous fermentation; viz. that the Chineſe make uſe of a certain liquor called *lamb wine*, and likewiſe that they uſe a kind of ſpirit diſtilled from *ſheeps fleſh*. This is related on the credit of M. Groſier: but as he does not mention the particulars of the proceſs, we are at liberty to ſuppoſe that the fleſh of theſe animals has been mixed with rice, or ſome other ingredients naturally capable of producing a vinous liquor; ſo that, inſtead of contributing any thing to the fermentation in queſtion, they may in reality be detrimental, and furniſh only that ſtrong and diſagreeable ſmell complained of in the liquid.

Fern || Fernelius.

kali. For the explanation of this proceſs, according to the principles of modern chemiſtry, ſee CHEMISTRY *Index*; and for the more general details of the proceſs, ſee BREWING, MALTING, and VINEGAR-*making*.

FERN, FILIX. See FILICES, BOTANY *Index*.

Fern is very common in dry and barren places. It is one of the worſt weeds for lands, and very hard to deſtroy where it has any thing of a deep ſoil to root in. In ſome grounds, the roots of it are found to the depth of eight feet. One of the moſt effectual ways to deſtroy it is often mowing the graſs; and, if the field is ploughed up, plentiful dunging thereof is very good: but the moſt certain remedy for it is urine. However, fern, cut while the ſap is in it, and left to rot upon the ground, is a very great improver of land.

In ſome places of the north, the inhabitants mow it green; and, burning it to aſhes, make thoſe aſhes up into balls with a little water. They then dry them in the ſun, and make uſe of them to clean their linen with; looking upon it to be near as good as ſoap for that purpoſe.

Male FERN. See POLYPODIUM, BOTANY *Index*.

Female FERN. See PTERIS, BOTANY *Index*.

FERNANDO, or FERNANDES, an iſland in the Pacific ocean. See *Juan Fernandes*.

FERNELIUS, JOHN, phyſician to Henry II. king of France, was born in Picardy, in the latter end of the 15th or the beginning of the 16th century. Being ſent to Paris to ſtudy rhetoric and philoſophy, he applied himſelf in a moſt intenſe manner. All other pleaſure was inſipid to him. He cared neither for play nor for walking, nor for entertainments, nor even for converſation. He read Cicero, Plato, and Ariſtotle. The reading of Cicero procured him this advantage, that the lectures he read on philoſophical ſubjects were as eloquent as thoſe of the other maſters were barbarous at that time. He alſo applied himſelf very earneſtly to the mathematics. This continual ſtudy drew upon him a long fit of ſickneſs, which obliged him to leave Paris. On his recovery, he returned thither with a deſign to ſtudy phyſic; but before he applied himſelf entirely to it, he taught philoſophy in the college of St Barbara. After this he ſpent four years in the ſtudy of phyſic; and taking a doctor's degree, confined himſelf to his cloſet, in order to read the beſt authors, and to improve himſelf in the mathematics; that is, as far as the buſineſs of his profeſſion would ſuffer him. Never was a man more diligent than Fernel. He uſed to riſe at four o'clock in the morning, and ſtudied till it was time either to read lectures or to viſit patients. He then examined the urine that was brought him; for this was the method of thoſe times, with regard to the poor people, who did not ſend for the phyſician. Coming home to dine, he ſhut himſelf up among his books till they called him down to table. Riſing from table, he returned to his ſtudy, which he did not leave without neceſſary occaſions. Coming home at night, he did juſt as at noon: he ſtaid among his books till they called him to ſupper; returned to them the moment he had ſupped; and did not leave them till 11 o'clock, when he went to bed. In the courſe of theſe ſtudies, he contrived mathematical inſtruments, and was at great charges in making them. But his wife murmuring at the expence, he diſmiſſed his inſtrument-makers, and applied himſelf in good earneſt to practiſe phyſic. But as viſiting patients did not employ his whole time, he read public lectures upon Hippocrates and Galen. This ſoon gained him a great reputation through France and in foreign countries. His buſineſs increaſing, he left off reading lectures; but as nothing could make him ceaſe to ſtudy in private, he ſpent all the hours he could ſpare in compoſing a work of phyſic, entitled *Phyſiologia*, which was ſoon after publiſhed. He was prevailed with to read lectures upon this new work, which he did for three years: and undertaking another work, which he publiſhed, *De venæ ſectione*, he laid himſelf under the neceſſity of reading lectures ſome years longer, in order to explain this new book to the youth. While he was thus employed, he was ſent for to court, in order to try whether he could cure a lady, whoſe recovery was deſpaired of. He was ſo happy as to cure her; which was the firſt cauſe of that eſteem which Henry II. who was then but dauphin, and was in love with that lady, conceived for him. This prince offered him, even then, the place of firſt phyſician to him; but Fernel, who infinitely preferred his ſtudies to the hurry of a court, would not accept the employment. When Henry came to the throne, he renewed his entreaties: but Fernel repreſented that the honour which was offered to him was due, for ſeveral reaſons, and as an hereditary right, to the late king's phyſician; and that, as for himſelf, he wanted ſome time to make experiments concerning ſeveral diſcoveries he had made relating to phyſic. The king admitted this: but as ſoon as Francis I.'s phyſician died, Fernel was obliged to go and fill his place at Henry II.'s court. And here juſt the contrary to what he dreaded came to paſs; for he enjoyed more reſt and more leiſure at court than he had done at Paris; and he might have conſidered the court as an agreeable retirement, had it not been for the journeys which the new civil war obliged the king to take. He died in 1558, leaving behind him a great many works, beſides what have been mentioned; as, *De abditis rerum cauſis*, ſeven books of Pathology, a book on Remedies, &c. They have been printed ſeveral times; with his life prefixed, written by William Plantius his diſciple.

Fernelius || Ferrara.

FERONIA, the Pagan goddeſs of woods and orchards. This deity took her name from the town Feronia, ſituated at the foot of Mount Soracte in Italy, where was a wood and temple conſecrated to her. That town and wood are mentioned by Virgil, in the catalogue of Turnus's forces. Strabo relates, that thoſe who ſacrificed to this goddeſs, walked barefoot upon burning coals, without being hurt. She was the guardian deity of freed men, who received their cap of liberty at her temple.

FERRARA, a city of Italy, in the territory of the pope, capital of a duchy of the ſame name. It is ſeated in an agreeable and fertile plain; watered by the river Po, which is a defence on one ſide; and on the other is encompaſſed by a ſtrong wall and deep broad ditches full of water, as well as by a good citadel, finiſhed by Pope Paul. In the middle of the city is a magnificent caſtle, which was formerly the palace of the dukes, and is not now the leaſt ornament of Ferrara. It is quite ſurrounded with water; and the arſenal, which is near it, deſerves the obſervation of travellers. Over againſt the palace is the duke's garden; with a park, called *Belvidere*

Ferrara || Ferrars.

Belvidere on account of its beauty. Behind the garden there is a palace, built with white marble, called the *palace of diamonds*, becauſe all the ſtones are cut diamond faſhion.

Ferrara had formerly a conſiderable trade; but it is now almoſt deſerted, being very poor, inſomuch that there is hardly a perſon to be ſeen in the ſtreets. This is owing to the exactions of the popes. The fortifications are now neglected, and the ancient univerſity is dwindled into a wretched college of the Jeſuits. However, in 1755, it was advanced to an archbiſhopric by Pope Clement XII. The country about it is ſo marſhy, that a ſhower or two of rain renders the roads almoſt impaſſable. It is 24 miles north-eaſt of Bologna, 38 north-weſt of Ravenna, 70 north-by-weſt of Florence, and 190 north of Rome. E. Long. 12. 14. N. Lat. 44. 36.

FERRARA, the duchy of; a province in the pope's territory, bounded on the north by the ſtate of Venice, on the weſt by the duchies of Mantua and Mirandola, on the ſouth by the Bologneſe and by Romagna, of which it was formerly a part, and on the eaſt by the gulf of Venice. It is 50 miles in length, and 43 in breadth along the coaſt; but grows narrower and narrower towards the Mantuan. This country is almoſt ſurrounded by the branches of the Po, which often overflow the country, and form the great morals of Comachio, which has a bad effect on the air. It is thin of people, and indifferently cultivated, though fit for corn, pulſe, and hemp. The Po and the lake of Comachio yield a large quantity of fiſh. Ferrara is the capital town; beſides which there are Arano, Comachio, Magnavacca, Belriguardo, Cento, Buendeno, and Ficherola. This duchy was formerly poſſeſſed by the houſe of Eſte. But the pope took poſſeſſion of it in 1598, after the death of Alphonſo II. duke of Ferrara, it being a fief of the church.

FERRARIA, a genus of plants, belonging to the gynandria claſs; and in the natural method ranking under the ſixth order, *Enſatæ*. See BOTANY *Index*.

FERRARS, GEORGE, a lawyer, poet, hiſtorian, and accompliſhed gentleman, was deſcended from an ancient family in Hertfordſhire, and born about the year 1510, in a village near St Alban's. He was educated at Oxford, and thence removed to Lincoln's Inn; where applying with uncommon diligence to the ſtudy of the law, he was ſoon diſtinguiſhed for his elocution at the bar. Cromwell, earl of Eſſex, the great miniſter of Henry VIII. introduced him to the king, who employed him as his menial ſervant, and, in 1535, gave him a grant of the manor of Flamſtead, in his native county. This is ſuppoſed to have been a profitable eſtate; nevertheleſs, Mr Ferrars being a gay courtier, and probably an expenſive man, about ſeven years after was taken to execution by a ſheriff's officer for a debt of 200 merks, and lodged in the compter. Being at this time member for Plymouth, the houſe of commons immediately interfered, and he ſoon obtained his liberty. He continued in favour with the king to the end of his reign, and in that of Edward VI. he attended the lord protector Somerſet as a commiſſioner of the army in his expedition to Scotland in 1548. In the ſame reign, the young king being then at Greenwich, Mr Ferrars was proclaimed *lord of miſrule*, that is, prince of ſports and paſtimes; which office he diſcharged during 12 days, in Chriſtmas holidays, to the entire ſatisfaction of the court. This is all we know of Mr Ferrars; except that he died in 1579, at Flamſtead in Hertfordſhire, and was buried in the pariſh church. He is not leſs celebrated for his valour in the field, than for his other accompliſhments as a gentleman and a ſcholar. He wrote, 1. Hiſtory of the Reign of Queen Mary; publiſhed in Grafton's chronicle, 1569, fol. 2. Six tragedies, or dramatic poems; publiſhed in a book called the *Mirror for Magiſtrates*, firſt printed in 1559, afterwards in 1587, and again in 1610.

Ferret || Ferro.

FERRET. See MUSTELA, MAMMALIA *Index*.

FERRETS, among glaſsmakers, the iron with which the workmen try the melted metal, to ſee if it be fit to work.—It is alſo uſed for thoſe irons which make the rings at the mouth of the bottles.

FERRETTO, in glaſs-making, a ſubſtance which ſerves to colour glaſs.

This is made by a ſimple calcination of copper, but it ſerves for ſeveral colours: there are two ways of making it. The firſt is this. Take thin plates of copper, and lay them on a layer of powdered brimſtone, in the bottom of a crucible; over theſe lay more brimſtone, and over that another layer of the plates, and ſo on alternately till the pot is full. Cover the pot, lute it well, place it in a wind furnace, and make a ſtrong fire about it for two hours. When it is taken out and cooled, the copper will be found ſo calcined, that it may be crumbled to pieces between the fingers like a friable earth. It will be of a reddiſh, and, in ſome parts, of a blackiſh colour. This muſt be powdered and ſifted fine for uſe.

Another way of making ferretto is as follows. Make a number of ſtratifications of plates of copper and white vitriol alternately in a crucible; which place on the floor of the glaſs furnace near the eye; and let it ſtand there three days; then take it out, and make a new ſtratification with more freſh vitriol; calcine again as before. Repeat this operation ſix times, and a moſt valuable ferretto will be obtained.

FERRO, (W. Long. 19. N. Lat. 28.), the moſt weſterly of the Canary iſlands, near the African coaſt, where the firſt meridian was lately fixed in moſt maps; but now, the geographers of almoſt every kingdom make their reſpective capitals the firſt meridian, as we do London. It is a dry and barren ſpot, affording no water except what is ſupplied in a very ſurpriſing manner by a tree which grows in theſe iſlands, called the FOUNTAIN-*Tree*.

FERRO, *Faro*, or *Feroe Iſlands*; a cluſter of little iſlands lying in the Northern ocean, between 61° 15′, and 62° 21′ N. Lat. and between 5° and 8° W. Long. They belong to Denmark. There are 17 which are habitable; each of which is a lofty mountain ariſing out of the waves, divided from the others by deep and rapid currents. Some of them are deeply indented with ſecure harbours; Providence ſeeming to have favoured mankind with the ſafeſt retreats in the moſt boiſterous ſeas. All are very ſteep, and moſt of them faced with moſt tremendous precipices. The ſurface of the mountains conſiſts of a ſhallow ſoil of remarkable fertility; for barley, the only corn ſown here, yields above 20 for one; and the graſs affords abundant paſturage for ſheep. The exports are, ſalted mutton and tallow, gooſe quills, feathers, and eider down; and, by

Feroe. by the induſtry of the inhabitants, knit woollen waiſtcoats, caps, and ſtockings. No trees beyond the ſize of juniper or ſtunted willows will grow here; nor are any wild quadrupeds to be met with except rats and mice, originally eſcaped from the ſhipping. Vaſt quantities of ſea fowl frequent the rocks; and the taking of them furniſhes a very perilous employment to the natives, as deſcribed under the article *Bird-Catching*.

The ſea which ſurrounds theſe iſlands is extremely turbulent. The tides vary greatly on the weſtern and eaſtern ſides. On the firſt, where is received the uninterrupted flood of the ocean from the remote Greenland, the tide riſes ſeven fathoms; on the eaſtern ſide it riſes only three. Dreadful whirlwinds, called by the Danes *oes*, agitate the ſea to a ſtrange degree; catch up a vaſt quantity of water, ſo as to leave a great temporary chaſm in the ſpot on which it falls, and carries away with it, to an amazing diſtance, any fiſhes which may happen to be within reach of its fury. Thus great ſhoals of herrings have been found on the higheſt mountains of Feroe. It is equally reſiſtleſs on land; tearing up trees, ſtones, and animals, and carrying them to very diſtant places.

Among the numerous whirlpools of theſe ſeas, that of Suderoe, near the iſland of the ſame name, is the moſt noted. It is occaſioned by a crater 61 fathoms in depth in the centre, and from 50 to 55 on the ſides. The water forms four fierce circumgirations. The point they begin at is on the ſide of a large baſon, where commences a range of rocks running ſpirally and terminating at the verge of the crater. This range is extremely rugged, and covered with water from the depth of 12 to 8 fathoms only. It forms four equidiſtant wreaths with a channel from 35 to 20 fathoms in depth between each. On the outſide, beyond that depth, the ſea ſuddenly ſinks to 80 and 90. On the ſouth border of the baſon is a lofty rock, called *Sumboe Munk*, noted for the multitude of birds which frequent it. On one ſide, the water is only 3 or 4 fathoms deep; on the other 15. The danger at moſt times, eſpecially in ſtorms, is very great. Ships are irreſiſtibly drawn in; the rudder loſes its power; and the waves beat as high as the maſts; ſo that an eſcape is almoſt miraculous; yet at the reflux, and in very ſtill weather, the inhabitants will venture in boats for the ſake of fiſhing.

Innumerable flocks of aquatic birds are continually to be ſeen perched on the extremities of the rocks, which make their neſts in the clefts above the precipices; and vaſt numbers of them may be killed by the diſcharge of a ſingle muſket, and the reſt will not ſtir, ſo little are they accuſtomed to be diſturbed. One of the iſlands contains but a ſingle habitation, which can be viſited by the curate only in ſummer. In the ſouthern part of theſe iſlands coal-mines were diſcovered about the beginning of the eighteenth century, and trials of the coals were only made in 1777, when it was judged that working them would be of ſufficient intereſt and conſequence. The quarry was determined by a commiſſary to be about 12,000 feet long, 4000 broad on a medium, and five feet deep; but ſo great did the difficulty of working it appear, that the idea was abandoned. The coals were analyzed by the celebrated profeſſor Kratzenſtein of Copenhagen, who found that they were ſuperior to thoſe of England, as burning longer, and giving a more intenſe heat, but not ſo eaſily kindled. A trial of them has been made in Scotland, and they are allowed to be of a ſuperior quality. It is a favourable circumſtance to the exportation of the produce of thoſe iſlands, that their harbours are never frozen, and navigation of conſequence could meet with no interruption during the winter. Ferro ‖ Fertility.

The meaſles and ſmall pox never attack the inhabitants but when they are brought there by ſtrangers, when the ravages they make are almoſt as terrible as thoſe of the peſtilence; but for 70 years back they have not been ſubjected to this dreadful viſitation. The air is temperate, and neither too hot in ſummer, nor extremely cold in winter. There are frequent miſts on theſe iſlands, but they do not ſeem to be injurious to the health of the inhabitants. The wind often blows with ſuch violence, that the people on horſeback are obliged to diſmount at its approach, which is announced by a whiſtling acroſs the rocks; and perſons on foot muſt throw themſelves flat on their face, to avoid the dreadful conſequences of the irreſiſtible hurricane. So ſudden is its approach at ſome times, that a burning candle might be carried in the open air but a few ſeconds before it. There is ſeldom any thunder on theſe iſlands; but when the phenomenon does happen, its awful and inceſſant roar among the rocks is truly alarming. Potatoes, the cultivation of which is rapidly advancing, thrive well, and the ſame is the caſe with radiſhes and turnips. Corn is not much cultivated, which would require exceſſive labour in a country ſo mountainous, and the ſpring fiſhery requires all the hands that can be ſpared. Trees cannot be made to grow upon them, and of conſequence there is no wood.

The number of inhabitants does not exceed 5000; and they are in general well made, with fair complexions, and their whiteneſs is very ſeldom impaired by the influence of the ſun. They are not deficient in underſtanding; and although phlegmatic, yet they are benevolent and hoſpitable, and are ſeldom known to quarrel. They are fond of brandy, and yet it is ſaid that they are very rarely ſeen in a ſtate of intoxication. They are frugal and upright, yet extremely credulous, and much addicted to ſuperſtitious practices. There are no ſchools among them, as parents educate their own children, and their knowledge of conſequence is very circumſcribed. They abound in ſkilful players at cheſs, but are wholly unacquainted with inſtruments of muſic, and dance to the ſound of the voice.

FERROL, a ſea port town of Spain, in the province of Gallicia, ſeated on a bay of the Atlantic ocean. It has a good harbour, and is frequented by the Spaniſh fleet in time of war. W. Long. 8. 46. N. Lat. 43. 26.

FERRUGINOUS, any thing partaking of iron, or which contains particles of that metal.

FERRUGO, RUST, or oxide of iron. See IRON, *Oxide of*, CHEMISTRY *Index*.

FERRUM, IRON. See IRON, CHEMISTRY *Index*.

FERRY, a liberty by preſcription, or by the king's grant, to have a boat for paſſage, on a frith or river, for carrying paſſengers, horſes, &c. over the ſame for a reaſonable toll.

FERTILITY, that quality which denominates a thing fruitful or prolific.

Nothing can produce fertility in either ſex, but what promotes

Ferula || Fescennine verses.

promotes perhaps health; nothing but good blood, ſpirits, and perfect animal functions, that is, high health, can beget perfect fecundity; and therefore, all means and medicines, all noſtrums and ſpecifics, to procure fertility, different from thoſe which procure good blood and ſpirits, are arrant quackery. Dr Cheyne ſays, that water-drinking males are very rarely infertile; and that if any thing in nature can prevent infertility, and bring fine children, it is a milk and ſeed diet perſevered in by both parents.

To increaſe the fertility of *vegetables*, ſays Lord Bacon, we muſt not only increaſe the vigour of the earth and of the plant, but alſo preſerve what would otherwiſe be loſt: whence he infers, that there is much ſaved by ſetting, in compariſon of ſowing. It is reported, continues he, that if nitre be mixed with water to the thickneſs of honey, and after a vine is cut, the bud be anointed therewith, it will ſprout within eight days. If the experiment be true, the cauſe may be in the opening of the bud, and contiguous parts, by the ſpirit of the nitre; for nitre is the life of vegetables.

How far this may be true, is not perhaps ſufficiently ſhown, notwithſtanding the experiments of Sir Kenelm Digby and M. Homberg. Conſult Mr Evelyn's Sylva, the Philoſophical Tranſactions, the French Memoirs, and Dr Stahl's Philoſophical Principles of Chemiſtry; but a proper ſet of accurate experiments ſeems ſtill wanting in this view.

FERULA, a little wooden pallet or ſlice, reputed the ſchoolmaſter's ſceptre, wherewith he chaſtiſes the boys, by ſtriking them on the palm of the hand. The word is Latin, and has alſo been uſed to denote the prelate's croſier and ſtaff. It is ſuppoſed to be formed of the Latin *ferire*, "to ſtrike." Under the eaſtern empire, the ferula was the emperor's ſceptre, as is ſeen on divers medals; it conſiſts of a long ſtem or ſhank, and a flat ſquare head. The uſe of the ferula is very ancient among the Greeks, who uſed to call their princes ῥαβδηκοφόροι, q. d. "ferula-bearers."

In the ancient eaſtern church, ferula or *narthex* ſignified a place ſeparated from the church; wherein the penitents or the catechumens of the ſecond order, called *auſcultantes*, ακροαματικοι, were kept, as not being allowed to enter the church; whence the name of the place, the perſons therein being under penance or diſcipline: *ſub* ferula *erant eccleſiæ*.

FERULA, *Fennel-giant*, a genus of plants belonging to the pentandria claſs, and in the natural method ranking under the 45th order, *Umbellatæ*. See BOTANY *Index*. The drug aſſafetida is obtained from a ſpecies of ferula.

FESCENNIA, or FESCENNIUM, in *Ancient Geography*, a town of Etruria, above Falerii; where the Feſcennine verſes were firſt invented. Now *Galeſe*, in the Eccleſiaſtical State, near the Tiber.

FESCENNINE VERSES, in antiquity, were a kind of ſatirical verſes, full of wanton and obſcene expreſſions, ſung or rehearſed by the company, with many indecent geſtures and dances, at the ſolemnization of a marriage among the Romans; (Hor. lib. v. ep. i. 145.) The word is borrowed, according to Macrobius, from *facinum*, "a charm;" the people taking ſuch ſongs to be proper to drive away witches, or prevent their effect; but its more probable origin is from Feſcennium, a city of Campania, where ſuch verſes were firſt uſed.

Feſſe || Fetlock.

FESSE, in *Heraldry*, one of the nine honourable ordinaries. See HERALDRY.

Feſſe Point, is the exact centre of the eſcutcheon. See POINT.

Feſſe Ways, or *in Feſſe*, denotes any thing borne after the manner of a feſſe; that is, in a rank acroſs the middle of the ſhield.

Party per Feſſe, implies a parting acroſs the middle of the ſhield, from ſide to ſide, through the feſſe point.

FESTI DIES, in Roman antiquity, certain days in the year devoted to the honour of the gods.

Numa, when he diſtributed the year into 12 months, divided the ſame into the *dies feſti*, *dies profeſti*, and *dies interciſi*.

The *feſti* were again divided into days of ſacrifices, banquets, games, and feriæ. See FERIÆ.

The *profeſti* were thoſe days allowed to men for the adminiſtration of their affairs, whether of a public or private nature: theſe are divided into faſti, comitiales, &c. See FASTI, COMITIALES, &c.

The *interciſi* were days common both to gods and men, ſome parts of which were alloted to the ſervice of the one, and ſome to that of the other.

FESTINO, in *Logic*, the third mood of the ſecond figure of the ſyllogiſm, the firſt propoſition whereof is an univerſal negative, the ſecond a particular affirmative, and the third a particular negative; as in the following example:

FES No bad man can be happy.
TI Some rich men are bad men.
NO *Ergo*, Some rich men are not happy.

FESTIVAL, a time of feaſting. See FEAST.—The term is particularly applied to anniverſary days of civil or religious joy.

FESTOON, in *Architecture* and *Sculpture*, &c. an ornament in form of a garland of flowers, fruits, and leaves, intermixed or twiſted together.

It is in the form of a ſtring or collar, ſomewhat biggeſt in the middle, where it falls down in an arch; being extended by the two ends, the extremities of which hang down perpendicularly.

Feſtoons are now chiefly uſed in friezes, and other vacant places which want to be filled up and adorned; being done in imitation of the long cluſters of flowers, which the ancients placed on the doors of their temples and houſes on feſtival occaſions.

FESTUCA, FESCUE GRASS, a genus of plants belonging to the triandria claſs, and in the natural method ranking under the 34th order, *Gramina*. See BOTANY and AGRICULTURE *Index*.

FESTUS POMPEIUS, a celebrated grammarian of antiquity, who abridged a work of Verrius Flaccus, *De Significatione Verborum*; but took ſuch liberties in caſtration and criticiſing, as, Gerard Voſſius obſerves, are not favourable to the reputation of his author. A complete edition of his fragments was publiſhed by M. Dacier in 1681, for the uſe of the Dauphin. Scaliger ſays, that Feſtus is an author of great uſe to thoſe who would attain the Latin tongue with accuracy.

FETLOCK, in the manege, a tuft of hair growing behind the paſtern joint of many horſes; for thoſe of a low ſize have ſcarce any ſuch tuft.

Fetti || Feverſham

FETTI, Domenico, an eminent painter in the ſtyle of Julio Romano, was born at Rome in 1589, and educated under Ludovico Civoli of Florence. He painted but little for churches, but excelled in hiſtory; his pictures are much ſought after, and are ſcarce.—He abandoned himſelf to diſorderly courſes; and put an end to his life by exceſſes, in the 35th year of his age.

FETUS. See Foetus.

FEUD, in our ancient cuſtoms, is uſed for a capital quarrel or enmity, not to be ſatisfied but with the death of the enemy: and thence uſually called *deadly feud*.—*Feud*, called alſo *fida*, and *faida*, in the original German, ſignifies *guerran*, i. e. *bellum*, "war." Lambert writes it *feeth*, and ſaith it ſignifies *capitales inimicitias*, or "implacable hatred."

In Scotland, and the north of England, feud is particularly uſed for a combination of kindred, to revenge the death of any of their blood, againſt the killer and all his race, or any other great enemy.

Feud (*Feoda*), the ſame with *Fief*, or *Fee*. See *Feodal Syſtem*.

FEUDAL, or Feodal, of or belonging to a feud or fee. See Feodal.

FEUDATORY, or Feodatory, a tenant who formerly held his eſtate by feodal ſervice. See *Feodal Tenure*.

FEU duty, in *Scots Law*, is the annual rent or duty which a vaſſal, by the tenor of his right, becomes bound to pay his ſuperior.

Feu-Holding, in *Scots Law*, is that particular tenure by which a vaſſal is taken bound to pay an annual rent or feu-duty to his ſuperior.

FEVER. See Medicine *Index*.

The ancients deified the diſeaſes as well as the paſſions and affections of men. Virgil places them in the entrance into hell, Æn. vi. 273. Among theſe *Fever* had a temple on Mount Palatine, and two other parts of ancient Rome; and there is ſtill extant an inſcription to this goddeſs. FEBRI. DIVÆ. FEBRI. SANCTÆ. FEBRI. MAGNÆ. CAMILLA. AMATA. PRO. FILIO. MALE. AFFECTO.

Fever, in *Farriery*. See Farriery *Index*.

FEVERFEW. See Matricaria, Botany *Index*.

FEVERSHAM, a town of the county of Kent in England, ſituated on a branch of the river Thames, which is navigable for boys. It was a royal demeſne A. D. 811, and called in Kenulf's charter the *King's little Town*, though it is now a large one. It was inhabited by the Britons long before the invaſion of Cæſar. In 903, King Athelſtan held a great council here. King Stephen erected a ſtately abbey, 1147, whoſe abbots ſat in parliament; and he was buried in it, together with Maud his queen, and Euſtace his ſon; but of this building two mean gate-houſes are all that now remain. The town was firſt incorporated by the name of the barons of Feverſham; afterwards by Henry VIII. with the title of the mayor and commonalty; and laſtly, by that of the mayor and jurats and commonalty. It is a populous flouriſhing place, conſiſting chiefly of two long broad ſtreets, with a market-houſe in the centre, built 1574. Its ancient church was re-built in 1754, at the expence of 2300l. but was originally built in Edward II's reign. There is a free grammar ſchool in this place, built and endowed by Queen Elizabeth in 1582; alſo two charity ſchools. It is a member of the cinque-port of Dover, and has a manufactory of gunpowder. The London markets are ſupplied from hence with abundance of apples and cherries, and the beſt oyſters for ſtewing. Theſe laſt were at one time carried away in ſuch quantities by the Dutch, that many men and boats were employed in the winter to dredge for them; and it is ſaid they carried home as many as amounted to above 2000l a-year. The fiſhermen admit none to take up their freedom but married men.

Fevildea || F. z.

FEVILDEA, a genus of plants belonging to the dioecia claſs, and in the natural method ranking under the 34th order, *Cucurbitaceæ*. See Botany *Index*.

FEVRE, Tanegui le, of Caen in Normandy, born in 1615, was an excellent ſcholar in Greek and Roman learning. Cardinal de Richelieu gave him a penſion of 2000 livres to inſpect all the works publiſhed at the Louvre, and deſigned to have made him principal of a college he was about to erect at Richelieu. But the cardinal's death cut off his hopes; and Cardinal Mazarine having no great reliſh for learning, his penſion was ill paid. Some time after the marquis de Franciere, governor of Langres, took him along with him to his government, and there he embraced the Proteſtant religion; after which he was invited to Saumur, where he was choſen Greek profeſſor. He there taught with extraordinary reputation. Young men were ſent to him from all the provinces in the kingdom, and even from foreign countries, while divines and profeſſors themſelves gloried in attending his lectures. He was preparing to go to Heidelberg, whither he was invited by the prince Palatine, when he died, aged 57. He wrote, 1. Notes on Anacreon, Lucretius, Longinus, Phædrus, Juſtin, Terence, Virgil, Horace, &c. 2. A ſhort account of the lives of the Greek poets. 3. Two volumes of letters: and many other works.

Fevre, *Claude*, an eminent French painter, was born at Fountainbleau in 1633, and ſtudied in the palace there, and then at Paris under Le Sueur and Le Brun; the latter of whom adviſed him to adhere to portraits, for which he had a particular talent, and in his ſtyle equalled the beſt maſters of that country. He died in England in 1675, aged 42.

FEZ, the capital of a kingdom of the ſame name in Barbary, in Africa. It is deſcribed as a very large place, ſurrounded with high walls, within which there are hills and valleys, only the middle being level and flat. The river, which runs through the city, is divided into two ſtreams, from which canals are cut into every part of the town: ſo that the moſques, colleges, palaces, and the houſes of great men, are amply ſupplied with water. They have generally ſquare marble baſons in the middle of the court of their houſes, which are ſupplied with water by marble pipes that paſs through the walls. They conſtantly run over, and the ſtream returns back into the ſtreet, and ſo into the river. The houſes are built with brick or ſtone; and are adorned on the outſide with fine moſaic work, or tiles like thoſe of Holland. The wood work and ceilings are carved, painted and gilt. The roofs are flat; for they ſleep on the tops of the houſes in ſummer. Moſt of the

Fez. houſes are two ſtories high, and ſome three. There are piazzas and galleries running all round the court on the inſide, ſo that you may go under cover from one apartment to another. The pillars are of brick, covered with glazed tiles, or of marble, with arches between. The timber work is carved and painted with gay colours, and moſt of the rooms have marble ciſterns of water. Some of the great men build towers over their houſes ſeveral ſtories high, and ſpare no expence to render them beautiful; from hence they have a fine proſpect all over the city. Fez.

There are in this city 700 moſques, great and ſmall, 50 of which are magnificent, and ſupported with marble pillars, and other ornaments. The floors are covered with mats, as well as the walls to the height of a man. Every moſque has a tower or minaret, like thoſe in Turkey, with a gallery on the top, from whence they call the people to prayers. The principal moſque is near a mile and a half in circumference. The middle building is 150 yards in length, and 80 in breadth, with a tower proportionably high. Round this to the eaſt, weſt, and north, there are great colonnades 30 or 40 yards long. There are 900 lamps lighted every night; and in the middle of the moſque are large branches, which are capable of holding 500 lamps each. Along the walls are ſeven pulpits, from which the doctors of the law teach the people. The buſineſs of the prieſt is only to read prayers, and diſtribute alms to the people; to ſupport which, there are large revenues.

Beſides the moſques, there are two colleges built in the Mooriſh manner, and adorned with marble and paintings. In one of them there are 100 rooms, beſides a magnificent hall. In this there is a great marble vaſe full of water, adorned with marble pillars of various colours, and finely poliſhed. The capitals are gilt, and the roof ſhines with gold, azure, and purple. The walls are adorned with Arabic verſes in gold characters. The other colleges are not near ſo beautiful, or rather are all gone to ruin ſince the neglect of learning.

There are hoſpitals in the city, where formerly all ſtrangers were maintained three days *gratis*. But the eſtates belonging to them have been confiſcated for the emperor's uſe. There are above 100 public baths, many of which are ſtately buildings. People of the ſame trade or buſineſs live in ſtreets by themſelves.

Though the country about Fez is pleaſant and fertile, and in many places abounding with corn and cattle, yet a great part of it lies waſte and uncultivated, not ſo much for want of inhabitants as from the oppreſſion of the governors; which makes the people chooſe to live at ſome diſtance from the high roads, where they cultivate juſt as much land as is neceſſary for their own ſubſiſtence.

Round the city there are fine marble tombs, monuments, and gardens full of all manner of fruit trees.

Such are the common accounts of this city. The following are given by M. Chenier, in his *Recherches Hiſtoriques ſur les Maures*.

Fez was built in the end of the eighth century by Edris, a deſcendant of Mahomet and of Ali; whoſe father, in order to avoid the proſcriptions of the caliph Abdalla, retired to the extremity of Africa, and was proclaimed ſovereign by the Moors. Sidy Edris, having ſucceeded to the throne of his father, built the city of Fez in the year 793. He cauſed a moſque to be erected, in which his body was interred, and the city ever afterwards became an aſylum for the Moors, and a place of devotion. In the firſt moments of fervour which a new worſhip inſpires, another moſque was built called *carubin*, which is perhaps one of the largeſt and moſt beautiful edifices in Africa. Several others were ſucceſſively built, beſides colleges and hoſpitals: and the city was held in ſuch veneration, that when the pilgrimage to Mecca was interrupted in the fourth century of the Hegira, the weſtern Mahometans ſubſtituted that of Fez in its ſtead, while the eaſtern people went to Jeruſalem. Fez.

When the Arabs had overſpread Aſia, Africa, and Europe, they brought to Fez the little knowledge they had acquired in the ſciences and arts; and that capital conjoined, with the ſchools of religion, academies where philoſophy was taught, together with medicine and aſtronomy. This laſt gradually degenerated; ignorance brought aſtrology into repute, and this quickly engendered the arts of magic and divination.

Fez ſoon became the common reſort of all Africa. The Mahometans went thither for the purpoſes of devotion; the affluence of ſtrangers introduced a taſte for pleaſure; libertiniſm quickly followed; and, as its progreſs is moſt rapid in warm countries, Fez, which had been the nurſe of ſciences and arts, became a harbour for every kind of vice. The public baths, which health, cleanlineſs, and cuſtom, had rendered neceſſary, and which were everywhere reſpected as ſacred places, became ſcenes of debauchery; where men introduced themſelves in the habits of women: youths in the ſame diſguiſe, with a diſtaff in their hands, walked the ſtreets at ſunſet in order to entice ſtrangers to their inns, which were leſs a place of repoſe than a convenience for proſtitution.

The uſurpers who diſputed the kingdom of Fez after the 16th century overlooked theſe abuſes, and contented themſelves with ſubjecting the maſters of the inns to furniſh a certain number of cocks for the army. It is to this laxity of diſcipline that Fez owed its firſt ſplendour. As the inhabitants are beautiful, the Africans flocked thither in crowds; the laws were overturned, morals deſpiſed, and vice itſelf turned into an engine of political reſource. The ſame ſpirit, the ſame inclinations, the ſame depravity, ſtill exiſt in the hearts of all the Moors. But libertiniſm is not now encouraged; it wears there, as in other places, the maſk of hypocriſy; and dares not venture to ſhow itſelf in the face of day.

The Mahometans of Andaluſia, thoſe of Granada and Cordova, migrated to Fez during the different revolutions that agitated Spain; they carried with them new cuſtoms and new arts, and perhaps ſome ſlight degree of civilization. The Spaniſh Moors carried from Cordova to Fez the art of ſtaining goat and ſheep ſkins with a red colour, which were then called Cordova leather, and now Morocco leather, from that city where the art is leſs perfect. They manufacture gauzes at Fez, ſilk ſtuffs, and girdles elegantly embroidered with gold and ſilk, which ſhow how far their ingenuity might be carried if induſtry were more encouraged.

There is ſtill ſome taſte for ſtudy preſerved at Fez, and the Arabic language is ſpoken there in greater purity

Fez, Fezzan

purity than in any other part of the empire. The rich Moors ſend their children to the ſchools at Fez, where they are better inſtructed than they could be elſewhere.

Leo Africanus, in the 16th century, gave a magnificent deſcription of this city, from which moſt of theſe that have been afterwards made are copied; but its ſituation, its ſchools, and the induſtry and great urbanity of its inhabitants, are the only circumſtances that give it any preference to the other cities of the empire. There are ſome pretty convenient inns here, conſiſting of two or three ſtories. The houſes have no elegance externally: the ſtreets are ill paved, and ſo ſtrait that two perſons riding abreaſt can hardly paſs. The ſhops are like ſtalls; and have no more room in them than is ſufficient to ſerve for the owner, who is always ſeated with his wares around him, which he ſhows to the paſſengers. But though the Moors of Fez are more civilized than the reſt, they are vain, ſuperſtitious, and intolerant; and an order muſt be obtained from the emperor before a Chriſtian or a Jew can be allowed to enter the city.

The ſituation of Fez is exceedingly ſingular. It lies in the bottom of a valley ſurrounded by little hills in the ſhape of a funnel; the declivities are divided into gardens planted with tall trees, orange ſhrubs, and all ſorts of fruit trees; a river meanders along the declivity, and turns a number of mills, which diſperſe the water abundantly to all the gardens, and almoſt to every houſe. The deſcent to the city, which ſtands in the centre, is long; and the road lies through theſe gardens, which it traverſes in a ſerpentine direction.

The gardens, ſeen from the city, form a moſt delightful amphitheatre. Formerly each garden had a houſe in which the inhabitants ſpent the ſummer. Theſe houſes were deſtroyed in the times of the civil wars, and in the revolutions to which Fez has been ſubject, and few individuals have reſtored them. The ſituation of Fez, however, cannot be healthful; moiſt vapours fill the air in ſummer, and fevers are exceedingly common.

On the height above Fez, in a plain ſuſceptible of rich cultivation, ſtands New Fez, finely ſituated, and enjoying excellent air, containing ſome old palaces, in which the children of the emperor live, and where he ſometimes reſides himſelf. New Fez is inhabited by ſome Mooriſh families, but by a greater number of Jews.

Fez is ſeated on the river Cebu. W. Long. 4. 25. N. Lat. 33. 58.

FEZZAN, a kingdom of Africa, about 300 miles long from north to ſouth, and 200 broad from eaſt to weſt. It is bounded on the eaſt by the Harutſch and line of the deſerts; by the country of the Tibboes on the ſouth and ſouth-eaſt; by that of the Nomadic Tuaricks on the ſouth-weſt; and the country which forms the weſtern boundary, is inhabited by Arabs. It contains 101 towns and villages, of which Mourzouk is the metropolis. The climate of this kingdom is neither temperate nor agreeable at any ſeaſon whatever; for the heat of ſummer is almoſt intolerable, even to the inhabitants, eſpecially when the wind blows from the ſouth; and the prevalence of the north wind during winter makes the cold ſo intenſe, as not only to chill the natives, but thoſe alſo who viſit it from northern regions. Fezzan

Rain falls but ſeldom in this country, and in very ſmall quantities. Thunder is alſo a rare phenomenon; Mr Horneman aſſures us that there was not a ſingle ſtorm from November 1798 to June 1799; and that on the laſt day of January 1799 there were ſome faint flaſhes of lightning unaccompanied by any claps of thunder. Winds, however, blow very frequently, both from the north and ſouth, whirling up the duſt and ſand in ſuch a manner as to give the atmoſphere a yellowiſh appearance. There is neither river nor rivulet of any conſequence in the whole country, according to Mr Horneman, who informs us that the ſoil is a deep ſand, beneath which is found calcareous rock or earth, and ſometimes a ſtratum of an argillaceous ſubſtance.

Date trees may be conſidered as the natural production of Fezzan, in the weſtern parts of which ſome ſenna grows, of a ſuperior quality to that which is imported from the country of the Tibboes. Culinary plants, and almoſt every vegetable peculiar to the garden, are met with in abundance. Wheat and barley ſeem well adapted to the nature of the ſoil, as well as to the climate; yet corn is not raiſed in ſufficient quantity for home conſumpt, which is brought from thoſe parts of Africa bordering on the northern parts of the kingdom. This is moſt probably owing to the native indolence of the people, the deſpotiſm of their government, and the difficulties inſeparable from their peculiar mode of tillage.

They beſtow little attention on the rearing of cattle, which are only found in the moſt fertile parts of the country, and even in theſe their numbers are but ſmall. They are made uſe of to draw water from the wells, and are never killed but in caſes of abſolute neceſſity. The common domeſtic animal is the goat; and although ſheep are reared in the ſouthern parts of the country, the moſt abundant ſupply is furniſhed by the Arabs on the borders. They make coarſe cloths of the wool, which conſtitute the apparel of the inhabitants in general. Their horſes are not numerous, as they make moſt uſe of aſſes, either for carriage, draught, or burthen. Camels bear a moſt extravagant price, being only made uſe of by the higher ranks, or by opulent merchants; and the common food of all theſe animals is the fruit of the date tree.

Although the trade of Fezzan conſiſts entirely of foreign articles, it is nevertheleſs conſiderable. Mourzouk is the great market and place of general reſort for different caravans from Cairo, Bengaſi, Tripoli, and other places, between the months of October and February. The caravans which come to Mourzouk from the weſt or ſouth, deal in oſtrich feathers, tiger ſkins, gold duſt, and alſo in ſlaves of both ſexes as articles of commerce. Tobacco and ſnuff, with other articles manufactured in Turkey, are brought to the capital by the merchants from Bengaſi; and paper, fire-arms, ſabres, knives, and woollen cloth, are conveyed to it from Tripoli.

Fezzan is governed by a ſultan, a deſcendant of the family of the Shereefs; and according to the tradition of the country, his anceſtors came from the weſtern parts of Africa, invaded and made a conqueſt of it about 500 years ago. He reigns over his dominions with abſolute

Fezzan. solute power, but is at the same time tributary to the bashaw of Tripoli, who annually receives from him the sum of 4000 dollars by the hands of an officer appointed for that purpose. The sultan who was upon the throne when Mr Horneman in 1798 visited the country, assumed the title of "Sultan Muhammed ben Sultan Mansur," engraved on a seal which is applied to all public acts, and also to correspondence within his dominions; but he makes use of a smaller seal when he writes to the bashaw of Tripoli. The crown is hereditary; yet it descends not in all cases from father to son, for when the heir apparent dies, a nephew may succeed in preference to a second son, which is frequently the occasion of much bloodshed, when the right of succession comes to be warmly contested. The palace of the sultan is within the walls of the fortress of the capital, where he leads a life of retirement attended by his eunuchs. The harem is near the palace, into which he never enters, as the female whom he inclines to see is conducted to his apartment. The harem consists of the sultana and about 40 female slaves, which last he frequently disposes of, and replaces them by others, unless they bear him children, or become the objects of his ardent attachment, either by their personal beauty or other accomplishments.

Those who wish for an audience with the sultan, approach the throne, which is an old elbow chair railed a few steps from the ground, kiss his hand, and raise it so as to touch their forehead, and then kneel before him to give a statement of their business in common language, taking care however, to intermix it with such exclamations as these: "God prolong thy life, God protect thy country," and to offer him some small present. The court of the sultan consists of a first and second minister, the general of his forces, a number of black and a few white slaves. Some of the black slaves who are purchased while boys, and educated according to their distinctions and talents, often acquire considerable influence with the sultan.

The dress of the sultan, when he appears in state, consists of a white frock of stuff, ornamented with gold and silver, and sometimes of satin interwoven with silver. The appearance of his turban is remarkable, which measures not less than three feet from the fore to the hinder part, and two feet in breadth. His revenue arises from certain taxes on all gardens and cultivated lands, and from fines and requisitions imposed in an arbitrary manner. The slaves who are employed in collecting these are often rigorous in the extreme, but it is often possible to procure their lenity by means of a bribe. The expenditure of this revenue is chiefly confined to the support of the sultan, his court and palace; for the cadi and department of justice, the religious order, and principal officers of government, are supported by the produce of date-tree woods and gardens..

The administration of justice is vested in the hands of a cadi, whose decisions are guided by the Mohammedan law, by antiquated customs, and established practice; but judgment in all criminal cases is purely arbitrary, or is referred to the sultan. The office of cadi has been hereditary in one family, ever since the conquest of the country by the ancestors of the present sultan; and when he dies, his place is filled up by one who is most eminent for learning, or who can best read and write, which is all the learning that he is ever possessed of.

It is difficult to ascertain any thing like an accurate statement of the population of Fezzan; but Mr Horneman conjectures that they may amount to about 75,000, all of them professing the religion of Mahomet. The complexion of the people varies considerably; those in the northern parts bearing in this respect a striking resemblance to the Arabians, while those in the southern districts are very much like the Tibboes and Tuaricks. Those who are strictly indigenous are of ordinary stature, and their limbs far from being muscular; of a deep brown colour, short black hair, with their face formed like the people of Europe, and their nose not so flat as that of the negro. Their walk, mein, and gesture, indicate a total want of energy, either of body or mind. Fezzan is Libya.

The women of this country are in general fond of dancing, and the wanton manners and public freedoms in which they are permitted to indulge, are frequently astonishing, even to Mahometans from other countries; and the men are very much addicted to the vice of drunkenness, using the juice of the date-tree, or a drink that is called *busa*, which is of an intoxicating nature.

Different species of the venereal disease prevail in this country, but that which is brought from Soudan is reckoned the most inveterate. The common lues venerea is called *franzi*, for the cure of which they make use of salts and colocynth as powerful cathartics, healing the sores with natron water or dissolved soda. They are sometimes afflicted with haemorrhoids, the cure of which is no doubt rendered more difficult by the too liberal use of red pepper; and a fever and ague which are very pernicious to foreigners. They are entirely unacquainted with phlebotomy, yet they sometimes draw blood by means of cupping; and some are as much acquainted with surgery as to be able to cure a simple fracture.

Their houses are miserable structures, composed of stones or bricks mixed with clay, and dried in the sun, and the hands of the labourer are all the tools which are employed in building. When the walls are finished, they are covered over with mortar made of calcareous earth, which is also done with the hand. Their houses are extremely low, and there is no other entrance for the light but by the door. They are uncommonly abstemious in respect of diet. Indeed they can never abstain from butcher meat when it is placed before them; but this is not an article of food with the generality, and their expression for a rich man is, "*that he eats* bread and meat every day."

FEWEL, See FUEL.

FIASCONE, a town of Italy, in the territories of the pope, remarkable for its good wine. E. Long. 13. 12. N. Lat. 42. 20.

FIAT, in *Law*, a short order or warrant signed by a judge, for making out and allowing certain processes.

FIBRARIÆ, an old term applied to minerals of a fibrous structure.

FIBRE, in *Anatomy*, a perfectly simple body, or at least as simple as any thing in the human structure; being fine and slender like a thread, and serving to form other parts. Hence some fibres are hard, as the bony ones; and others soft, as those destined for the formation of all the other parts.

The fibres are divided also, according to their position and

Fibre || Ficinus.

and direction, into ſuch as are ſtraight, oblique, tranſverſe, annular, and ſpiral; as they are arranged in theſe directions in different parts of the body.

FIBRE is alſo uſed to denote the ſlender FILAMENTS which compoſe other bodies, whether animal, vegetable, or mineral; but more eſpecially the capillary roots of plants.

FIBROSE, or FIBROUS, ſomething conſiſting of fibres, as the roots of plants. See ROOT.

FIBULA, in *Anatomy*, the outer and ſmaller of the bones of the leg. See ANATOMY *Index*.

FIBULA, in *Surgery*, an inſtrument in uſe among the ancients for the cloſing of gaping wounds.—Celſus ſpeaks of the fibula as to be uſed when the wound was ſo patent as not eaſily to admit of being ſewed. (*Op.* lib. vii. cap. 25. *apud fin.*)

FIBULA, in *Antiquity*, was a ſort of button, buckle, or claſp, made uſe of by the Greeks and Romans for keeping cloſe or tying up ſome part of their clothes. They are of various forms, and often adorned with precious ſtones. Men and women wore them in their hair and at their ſhoes. Players and muſicians, by way of preſerving the voices of children put under their care to learn their arts, uſed to keep cloſe the prepuce with a fibula, leſt they ſhould have commerce with women.

FICINUS, MARSILIUS, a celebrated Italian was born at Florence in 1433, and educated at the expence of Laurence de Medicis. He attained a perfect knowledge of the Greek and Latin tongues, and became a great philoſopher, a great phyſician, and a great divine. He was in the higheſt favour with Laurence and Coſmo de Medicis, who made him a canon of the cathedral church of Florence. He applied himſelf intenſely to the ſtudy of philoſophy; and while others were ſtriving who ſhould be the deepeſt read in Ariſtotle, who was then the philoſopher in faſhion, he devoted himſelf wholly to Plato. He was indeed the firſt who reſtored the Platonic philoſophy in the weſt; for the better effecting of which he tranſlated into Latin the whole works of Plato. There goes a ſtory, but we know not how true it is, that when he had finiſhed his tranſlation, he communicated it to his friend Marcus Muſurus, to have his approbation of it; but that, Muſurus diſliking it, he did it all over again. He next tranſlated Plotinus; and afterwards the works, or part of them at leaſt, of Proclus, Jamblicus, Porphyrius, and other celebrated Platoniſts.—In his younger years, Ficinus lived like a philoſopher; and too much ſo, as is ſaid, to the neglect of piety. However, Savonarola coming to Florence, Ficinus went with every body elſe to hear his ſermons; and while he attended them for the ſake of the preacher's eloquence, he imbibed a ſtrong ſenſe of religion, and devoted himſelf henceforward more eſpecially to the duties of it. He died at Correggio in 1499; and as Boronius aſſures us upon the teſtimony of what he calls credible authors, appeared immediately after his death to his friend Michael Mercatus: to whom, it ſeems, he had promiſed to appear, in order to confirm what he had taught concerning the immortality of the ſoul. His writings, ſacred and profane, which are very numerous, were collected and printed at Venice, in 1516, at Baſil in 1561 and 1576, and at Paris 1641, in two vols. folio. Twelve books of his Epiſtles, among which are many treatiſes, were printed ſeparately in folio at Venice 1495, and at Nuremberg 1497. In 4to.

FICOIDES, the ſpecific name given to ſeveral plants, as the meſembryanthemum, muſa, and opuntia. See MESEMBRYANTHEMUM, &c. BOTANY *Index*.

FICTION. See FABLE and POETRY.

FICUS, the FIG-TREE; a genus of plants, belonging to the polygamia claſs; and in the natural method ranking under the 53d order, *Scabridæ*. See BOTANY *Index*.

The ficus religioſa, or Banian tree, is a native of ſeveral parts of the Eaſt Indies. It has a woody ſtem, branching to a great height and vaſt extent, with heart-ſhaped entire leaves ending in acute points. Of this tree the following lines of Milton contain a deſcription equally beautiful and juſt:

> ———There ſoon they choſe
> The fig-tree: not that tree for fruit renown'd;
> But ſuch as, at this day to Indians known
> In Malabar or Decan, ſpreads her arms,
> Branching ſo broad and long, that in the ground
> The bended twigs take root, and daughters grow
> About the mother tree, a pillar'd ſhade,
> High overarch'd, and echoing walks between;
> There oft' the Indian herdſman, ſhunning heat,
> Shelters in cool, and tends his paſturing herds
> At loop-holes cut through thickeſt ſhade.
>
> *Par. Loſt*, Book ix. l. 1100.

The Banian tree, or Indian fig, is perhaps the moſt beautiful of Nature's productions in that genial climate, where ſhe ſports with the greateſt profuſion and variety. Some of theſe trees are of amazing ſize and great extent, as they are continually increaſing, and, contrary to moſt other things in animal and vegetable life, they ſeem to be exempted from decay. Every branch from the main body throws out its own roots; at firſt, in ſmall tender fibres, ſeveral yards from the ground: theſe continually grow thicker until they reach the ſurface; and then ſtriking in, they increaſe to large trunks, and become parent trees, ſhooting out new branches from the top: theſe in time ſuſpend their roots, which, ſwelling into trunks, produce other branches; thus continuing in a ſtate of progreſſion as long as the earth, the firſt parent of them all, contributes her ſuſtenance. The Hindoos are particularly fond of the Banian tree; they look upon it as an emblem of the Deity, from its long duration, its outſtretching arms, and overſhadowing beneficence; they almoſt pay it divine honours, and

> Find a fane in every ſacred grove.

Near theſe trees the moſt eſteemed pagodas are generally erected; under their ſhades the Brahmins ſpend their lives in religious ſolitude; and the natives of all caſts and tribes are fond of recreating in the cool receſſes, beautiful walks, and lovely viſtas of this umbrageous canopy, impervious to the hotteſt beams of a tropical ſun.

A remarkable large tree of this kind grows on an iſland in the river Nerbudda, ten miles from the city of Baroche in the province of Guzerat: a flouriſhing ſettlement lately in poſſeſſion of the Eaſt India Company, but ceded by the government of Bengal, at the treaty of peace concluded with the Mahrattas in 1783,

to

Ficus
||
Fide-juſſor

to Mahdajee Scindia a Mahratta chief. It is diſtinguiſhed by the name of Cubbeer Burr, which was given it in honour of a famous ſaint. It was once much larger than at preſent; but high floods have carried away the banks of the iſland where it grows, and with them ſuch parts of the tree as had thus far extended their roots: yet what remains is about 2000 feet in circumference, meaſured round the principal ſtems; the overhanging branches, not yet ſtruck down, cover a much larger ſpace. The chief trunks of this ſingle tree (which in ſize greatly exceed our Engliſh elms and oaks), amount to 350; the ſmaller ſtems, forming into ſtronger ſupporters, are more than 3000; and every one of theſe is caſting out new branches, and hanging roots, in time to form trunks, and become the parents of a future progeny. Cubbeer Burr is famed throughout Hindoſtan for its great extent and ſurpaſſing beauty: the Indian armies generally encamp around it; and, at ſtated ſeaſons, ſolemn jatarras, or Hindoo feſtivals, are held there, to which thouſands of votaries repair from various parts of the Mogul empire.—It is ſaid that 7000 perſons find ample room to repoſe under its ſhade. The Engliſh gentlemen, on their hunting and ſhooting parties, uſed to form extenſive encampments, and ſpend weeks together under this delightful pavilion, which is generally filled with green wood pigeons, doves, peacocks, and a variety of feathered ſongſters; crowded with families of monkeys performing their antic tricks; and ſhaded by bats of a large ſize, many of them meaſuring upwards of ſix feet from the extremity of one wing to the other. This tree not only affords ſhelter, but ſuſtenance, to all its inhabitants, being covered amid its bright foliage with ſmall figs of a rich ſcarlet, on which they regale with as much delight, as the lords of creation on their more coſtly fare in their parties.

FIDD, an iron pin uſed at ſea to ſplice or faſten ropes together; it is made tapering and ſharp at one end.

There are alſo fidds of wood, which are much larger than the iron ones.

The pin alſo in the heel of the topmaſt, which bears it upon the chefs-tree, is called a *fidd*.

Fidd-Hammer, is uſed for a hammer, the handle of which is a fidd, or made tapering into that form.

FIDDLE. See VIOLIN.

Fiddle-Wood. See CITHAREXYLON, BOTANY *Index*.

FIDDES, RICHARD, a learned divine and polite writer, was born in 1671, and educated at Oxford. He was preſented to the living of Halſham in Yorkſhire, where he was ſo admired for the ſweetneſs of his voice and the gracefulneſs of his delivery, that the people for ſeveral miles round flocked to his ſermons. Coming to London in 1712, he was by the favour of Dean Swift, introduced to the earl of Oxford, who made him one of his chaplains, and the queen ſoon after appointed him chaplain to the garriſon at Hull: but loſing his patrons upon the change of the miniſtry, he loſt his chaplainſhip; and being obliged to apply himſelf to writing, compoſed, 1. A body of Divinity; 2. The Life of Cardinal Wolſey; 3. A Treatiſe of Morality, &c. He died in 1725.

FIDE-JUSSORES *Affidui*. See ASSIDUUS.

Fide-Juſſor, in the *Civil Law*, is a ſurety, or one that obliges himſelf in the ſame contract with a principal, for the greater ſecurity of the creditor or ſtipulator.

FIDEI-COMMISSUM, in Roman antiquity, an eſtate left in truſt with any perſon, for the uſe of another. See TRUSTEE.

Fidei-commiſſum
||
Fielding.

FIDENA, or FIDENÆ, in *Ancient Geography*, a town of the Sabines, five miles to the north of Rome, where traces of it are ſtill to be ſeen. Fidenates, the people (Livy.)

FIDES, FAITH or FIDELITY, one of the virtues deified by the Pagans. She had a temple near the Capitol, founded by Numa Pompilius; but no animals were offered, or blood ſpilt, in her ſacrifices. During the performance of her rites, her prieſts appeared in white veſtments, with their heads and hands covered with linen, to ſhow that fidelity ought to be ſacred.

FIDIUS, in Pagan worſhip, a god who preſided over alliances and promiſes. This deity, which the Romans borrowed from the Sabines, was alſo called *Sanctus*, *Semon*, and *Semi-Pater*.

FIELD, in *Agriculture*, a piece of ground encloſed, whether for tillage or paſture.

FIELD, in *Heraldry*, is the whole ſurface of the ſhield or the continent, ſo called becauſe it containeth thoſe achievements anciently acquired in the field of battle. It is the ground on which the colours, bearing, metals, furs, charges, &c. are repreſented. Among the modern heralds, field is leſs frequently uſed in blazoning than ſhield or eſcutcheon. See SHIELD, &c.

Field-Book, in *Surveying*, a book in which the angles, ſtations, diſtances, &c. are ſet down.

Field-Colours, or *Camp-Colours*, in *War*, are ſmall flags of about a foot and a half ſquare, which are carried along with the quartermaſter general, for marking out the ground for the ſquadrons and battalions.

Field-Fare, in *Ornithology*. See TURDUS, ORNITHOLOGY *Index*.

Field-Officers, in the art of war. See OFFICER.

Field-Pieces, ſmall cannons, from three to twelve pounders, carried along with an army in the field.

Field-Staff, a weapon carried by the gunners, about the length of a halbert, with a ſpear at one end; having on each ſide ears ſcrewed on, like the cock of a matchlock, where the gunners ſcrew in lighted matches when they are upon command; and then the field-ſtaffs are ſaid to be armed.

Field-Works, in *Fortification*, are thoſe thrown up by an army in beſieging a fortreſs, or by the beſieged to defend the place. Such are the fortifications of camps, highways, &c.

Elyſian Fields. See ELYSIAN.

FIELDING, HENRY, a well-known writer of the preſent age, ſon of Lieutenant-general Fielding who ſerved under the duke of Marlborough, was born in 1707. He had four ſiſters; of whom Sarah is well known, as writer of The Adventures of David Simple. On the death of his mother, his father married again; and Sir John Fielding, who ſucceeded him in the commiſſion of the peace for Middleſex, is his brother by this marriage. Henry was ſent to ſtudy at Leyden; but a failure in his remittances obliged him to return in two years, when his own propenſity to gaiety and profuſion drove him to write for the ſtage at 20 years of age. His firſt dramatic piece, Love in ſeveral Maſques, which was well received, appeared in 1727; and all his plays and farces, to the amount of 18, were written before

Fienus || Fife bi.e.

before the year 1737, and many of them are ſtill acted with applauſe. While he was thus employed, he married a young lady with 1500l. fortune, and inherited an eſtate of 200l. a-year from his mother; all which, though on the plan of retiring into the country, he contrived to diſſipate in three years; and then applied himſelf to the ſtudy of the law for a maintenance. In loſing his fortune, he acquired the gout; which, rendering it impoſſible for him to attend the bar, he with a ſhattered conſtitution had recourſe to many extempore applications of his pen for immediate ſupplies; until, ſoon after the rebellion in 1745, he accepted the office of acting juſtice for Middleſex, an employment much more profitable than honourable in the public eſteem. Reduced at length by the fatigues of this office, and by a complication of diſorders, he, by the advice of his phyſicians, went to Liſbon, where he died in 1754. He wrote a great number of fugitive pamphlets and periodical eſſays; but is chiefly diſtinguiſhed by his Adventures of Joſeph Andrews, and Hiſtory of Tom Jones. His works have been collected and publiſhed, with his life prefixed, by Mr Murphy.

FIENUS, THOMAS, an ingenious and learned phyſician, born at Antwerp in 1566. He went into Italy to ſtudy phyſic under Mercurialis and Aldrovandus; and on his return diſtinguiſhed himſelf ſo much in the univerſity of Louvain, that he was there choſen profeſſor of phyſic, and was afterwards made phyſician to the duke of Bavaria. He wrote ſeveral works, among which were, *De viribus imaginationis*; and *De formatione fœtus*. He died at Louvain in 1631.

FIERI FACIAS, in *Law*, a writ that lies where a perſon has recovered judgment for debt or damages in the king's courts againſt one, by which the ſheriff is commanded to levy the debt and damages on the defendant's goods and chattels.

FIFE, in *Muſic*, is a ſort of wind inſtrument, being a ſmall pipe. See PIPE.

FIFESHIRE, a county of Scotland, lying between the friths of Tay and Forth; bounded on the north and north-eaſt by the frith of Tay, which divides it from Perth and Angus; on the ſouth by the frith of Forth, which ſeparates it from the Lothians; the German ocean bounds it on the eaſt; and on the weſt it borders with the counties of Perth and Kinroſs, and a ſmall corner of Clackmannan. It extends about 60 miles in length from Culroſs to Fifeneſs, and is about 18 in breadth; comprehending a ſuperficies of nearly 480 ſquare miles. The face of the country is agreeably diverſified; towards the weſt it is mountainous, and a ridge of hills extends eaſtward almoſt its whole length, occupying the central diſtrict; towards the north and ſouth the ſurface gradually deſcends to the friths, exhibiting the moſt beautiful and enlivening proſpect of fertile and well cultivated fields. It is watered by ſeveral ſtreams, none of which deſerve the name of rivers, except the Eden and Leven; the former empties itſelf into the ocean at St. Andrews, and the latter at the village of Leven: both theſe rivers abound with trout and ſalmon; and on no coaſt of Scotland is the white fiſhing more productive than on the Fife coaſt. From its ſituation, it appears to have been very early inhabited; the fiſhings, coal mines, harbours, and other advantages for navigation, attracted ſettlers, and the coaſt was firſt peopled and beſt cultivated: this appears to have been the caſe, when King James VI. compared the county to a gray mantle with a gold fringe. The whole coaſt is covered with ſmall burghs, which that monarch regarded with particular attention, and very early in his reign endeavoured to render them ſubſervient to his wiſhes, of raiſing Scotland high in the world as a commercial nation; he granted them many privileges and immunities, and encouraged the inhabitants by every means in his power, to proſecute the advantages which, by their local ſituation, they poſſeſſed; indeed, the municipal privileges which they received from that monarch, though rendered unimportant by the union with England, will long remain a monument of his political ſagacity and diſcernment. The county can boaſt of poſſeſſing ſeveral ancient ſeats of royalty: at Dunfermline, at Falkland, at Kinghorn, and at St Andrews, veſtiges of royal ſplendour are ſtill to be ſeen. It contains 13 royal boroughs, which poſſeſs parliamentary repreſentation, and ſeveral which have loſt that privilege from their being unable to defray the expence which attended the ſending a commiſſioner to the Scottiſh parliament. To the county alſo belong the ſmall iſland of May, on which there is a lighthouſe, and Inchgarvie. Fifeſhire is divided into 60 pariſhes, and contains, by the enumeration in 1801, 93,743 inhabitants, being nearly 196 to the ſquare mile; a much greater proportion than is to be found in any other county in Scotland. It was anciently an earldom in the Macduff family, created by Malcolm III. for the ſervices performed by the thane of Fife, in reſtoring him to the throne of Scotland, when uſurped by Macbeth. That title having expired, it was lately revived in the Duffs of Braco, lateral deſcendents of the ancient family: the ruins of the reſidences of that powerful nobleman are ſtill evident in many parts of the county. The whole of the ſouth ſide lies upon coal, and many pits are wrought on every part of the coaſt: in many places is excellent limeſtone; and ſome marl is found in the county. Ironſtone, of excellent quality, is found in the weſtern and middle quarters, and much is forged in the county, or exported to the Carron works. Lead ore is found in the Eaſtern Lomond, one of the two conical hills which riſe nearly in the middle of the county, and are ſeen at a great diſtance: in Kemback pariſh alſo lead ore has been wrought. The county of Fife ſends one member to parliament. Cupar is the county town.

Fifeſhire.

The following account of the population of Fifeſhire at two different periods, is taken from the *Statiſt. Hiſt. of Scotland.*

	Pariſhes.	Population in 1755.	Population in 1790-98.
1	Abbotſhall	1348	2136
	Abdie	822	494
	Aberdour	1198	1280
	Anſtruther	1100	1000
5	Anſtruther, Weſter	385	370
	Auchterderran	1143	1200
	Auchtermuchty	1308	1439
	Auchtertool	389	334
	Ballingry	464	220
10	Balmerino	565	703
	Beath	1099	450
	Burntiſland	1390	1210

Cameron.

Fifeſhire || Figural.

	Parijhes.	Population in 1755.	Population in 1790—98.
	Cameron	1295	1165
	Carnbee	1293	1041
15	Carnock	583	970
	Ceres	2540	2320
	Coleſſie	989	949
	Crail	2173	1710
	Creich	375	306
20	Cult	449	534
	Cupar	2192	3702
	Dairſie	469	540
	Dalgety	761	869
	Denbog	255	235
25	Denino	598	383
	Dunfermline	8552	9550
	Dyſart	2369	4862
	Elie	642	620
	Falkland	1795	2198
30	Ferrie	621	875
	Fliſk	318	331
	Forgan	751	875
	Inverkeithing	1694	2210
	Kemback	420	588
35	Kennoway	1240	1500
	Kettle	1621	1759
	Kilconquhar	2131	2013
	Kilmaney	781	869
	Kilrenny	1348	1086
40	Kinghorn	2389	1768
	Kinglaſſie	998	1200
	Kingſbarns	871	807
	Kirkaldy	2296	2673
	Largo	1396	1913
45	Leſly	1130	1212
	Leuchars	1691	1620
	Logie	413	425
	Markinch	2188	2790
	Monimail	884	1101
50	Moonfie	249	171
	Newburgh	1347	1664
	Newburn	438	456
	Pittenweem	939	1157
	St Andrew's and St Leonard's	4913	4335
55	St Monance	780	832
	Saline	1285	950
	Scoonie	1528	1675
	Strathmiglo	1695	980
	Torryburn	1635	1600
60	Wemyſs	3041	3025
	Total	81,570	87,250
			81,570
	Increaſe,		5680

Fife-Rails, in a ſhip, are thoſe that are placed on baniſters, on each ſide of the top of the poop, and ſo along with haunces or falls. They reach down to the quarter deck, and to the ſtair of the gangway.

FIFTH, in *Muſic*. See INTERVAL.

FIG, or FIG-TREE. See FICUS, BOTANY *Index*.

FIGWORT. See SCROPHULARIA, BOTANY *Index*.

FIGURAL, FIGURATE, or *Figurative*, a term applied to whatever is expreſſed by obſcure reſemblances. The word is chiefly applied to the types and myſteries of the Moſaic law; as alſo to any expreſſion which is not taken in its primary and literal ſenſe. Figural Number Figure.

FIGURATE Numbers. See *NUMBERS, Figurate*.

FIGURE, in *Phyſics*, expreſſes the ſurface or terminating extremities of any body.

FIGURES, in *Arithmetic*, are certain characters whereby we denote any number which may be expreſſed by any combination of the nine digits, &c. See ARITHMETIC.

FIGURE, among divines, is uſed for the myſteries repreſented under certain types.

FIGURE, in *Dancing*, denotes the ſeveral ſteps which the dancer makes in order and cadence, conſidered as they mark certain figures on the floor. See DANCING.

FIGURE, in *Painting* and *Deſigning*, denotes the lines and colours which form the repreſentation of any animal, but more particularly of a human perſonage. See PAINTING.

FIGURE, in the manufactures, is applied to the various deſigns repreſented or wrought on velvets, damaſks, taffeties, ſatins, and other ſtuffs and cloths.

The moſt uſual figures for ſuch deſigns are flowers imitated from the life; or groteſques, and compartiments of pure fancy. Repreſentations of men, beaſts, birds, and landſcapes, have only been introduced ſince the taſte for the Chineſe ſtuffs, particularly thoſe called *furees*, began to prevail among us. It is the woof of the ſtuff that forms the figures; the warp only ſerves for the ground. In working figured ſtuffs there is required a perſon to ſhow the workman how far he muſt raiſe the threads of the warp, to repreſent the figure of the deſign with the woof, which is to be paſſed acroſs between the threads thus raiſed. This ſome call *reading the deſign*.

For the figures on tapeſtry, brocade, &c. ſee TAPESTRY, &c.

For thoſe given by the calenders, printers, &c. ſee CALENDAR, &c.

FIGURE, in *Logic*, denotes a certain order and diſpoſition of the middle term in any ſyllogiſm.

Figures are fourfold. 1. When the middle term is the ſubject of the major propoſition, and the predicate of the minor, we have what is called the firſt figure. 2. When the middle term is the predicate of both the premiſes, the ſyllogiſm is ſaid to be in the ſecond figure. 3. If the middle term is the ſubject of the two premiſes, the ſyllogiſm is in the third figure: and laſtly, by making it the predicate of the major, and ſubject of the minor, we obtain ſyllogiſms in the fourth figure. Each of theſe figures has a determinate number of moods, including all the poſſible ways in which propoſitions differing in quantity or quality can be combined, according to any diſpoſition of the middle term, in order to arrive at a juſt concluſion. See LOGIC.

FIGURE, in compoſition. See ORATORY; alſo ALLEGORY, APOSTROPHE, HYPERBOLE, METAPHOR, PERSONIFICATION, &c.

A FIGURE, the means or inſtrument conceived to be the agent. When we ſurvey a number of connected objects, that which makes the greateſt figure employs chiefly our attention; and the emotion it raiſes, if lively, prompts us even to exceed nature in the conceptions we form of it. Take the following examples.

For

Figure.

For Neleus' ſon Alcides' *rage* had ſlain.

A broken rock the *force* of Pirus threw.

In theſe inſtances, the rage of Hercules and the force of Pirus, being the capital circumſtances, are ſo far exalted as to be conceived the agents that produce the effects.

In the firſt of the following inſtances, hunger being the chief circumſtance in the deſcription, is itſelf imagined to be the patient.

Whoſe hunger has not taſted food theſe three days.
Jane Shore.

——————As when the *force*
Of ſubterranean wind tranſports a hill.
Paradiſe Loſt.

——————As when the *potent rod*
Of Amram's ſon, in Egypt's evil day,
Wav'd round the coaſt, upcall'd a pitchy cloud
Of locuſts. *Paradiſe Loſt.*

A FIGURE, *which, among related objects, extends the properties of one to another.* This figure is not dignified with a proper name, becauſe it has been overlooked by writers. *Giddy brink*, *jovial wine*, *daring wound*, are examples of this figure. Here are adjectives that cannot be made to ſignify any quality of the ſubſtantives to which they are joined: a *brink*, for example, cannot be termed *giddy* in a ſenſe, either proper or figurative, that can ſignify any of its qualities or attributes. When we examine attentively the expreſſion, we diſcover, that a *brink* is termed *giddy* from producing that effect in thoſe who ſtand on it: in the ſame manner, a wound is ſaid to be *daring*, not with reſpect to itſelf, but with reſpect to the boldneſs of the perſon who inflicts it: and wine is ſaid to be *jovial*, as inſpiring mirth and jollity. Thus the attributes of one ſubject are extended to another with which it is connected; and the expreſſion of ſuch a thought muſt be conſidered as a figure, becauſe the attribute is not applicable to the ſubject in any proper ſenſe.

How are we to account for this figure, which we ſee lies in the thought, and to what principle ſhall we refer it? Have poets a privilege to alter the nature of things, and at pleaſure to beſtow attributes upon a ſubject to which they do not belong? It is obſerved †, that the mind paſſeth eaſily and ſweetly along a train of connected objects; and, where the objects are intimately connected, that it is diſpoſed to carry along the good or bad properties of one to another; eſpecially when it is in any degree inflamed with theſe properties. From this principle is derived the figure under conſideration. Language, invented for the communication of thought, would be imperfect, if it were not expreſſive even of the ſlighter propenſities and more delicate feelings: but language cannot remain ſo imperfect among a people who have received any poliſh; becauſe language is regulated by internal feeling, and is gradually improved to expreſs whatever paſſes in the mind. Thus for example, when a ſword in the hand of a coward is termed *a coward ſword*, the expreſſion is ſignificative of an internal operation; for the mind, in paſſing from the agent to its inſtrument, is diſpoſed to extend to the latter the properties of the former. Governed by the ſame principle, we ſay *liſtening* fear, by extending the attribute *liſtening* of the man who liſtens, to the paſſion with which he is moved. In the expreſſion *bold deed*, or *audax facinus*, we extend to the effect what properly belongs to the cauſe. But not to waſte time by making a commentary upon every expreſſion of this kind, the beſt way to give a complete view of the ſubject, is to exhibit a table of the different relations that may give occaſion to this figure. And in viewing the table, it will be obſerved, that the figure can never have any grace but where the relations are of the moſt intimate kind.

† Vid. *Elem. of Criticiſm*, ch. ii part 1 ſect. 6.

Figure.

1. An attribute of the cauſe expreſſed as an attribute of the effect.

Audax facinus.
Of yonder fleet a *bold* diſcovery make.
An impious mortal gave the *daring* wound.

——————To my *advent'rous* ſong,
That with no middle flight intends to ſoar.
Paradiſe Loſt.

2. An attribute of the effect expreſſed as an attribute of the cauſe.

Quos periiſſe ambos *miſero* cenſebam in mari.
PLAUTUS.

No wonder, fallen ſuch a *pernicious* height.
Paradiſe Loſt.

3. An effect expreſſed as an attribute of the cauſe.

Jovial wine, Giddy brink, Drowſy night, Muſing midnight, Panting height, Aſtoniſh'd thought, Mournful gloom.

Caſting a dim *religious* light. MILTON, *Comus.*
And the *merry* bells ring round,
And the *jocund* rebecks ſound. MILTON, *Allegro.*

4. An attribute of a ſubject beſtowed upon one of its parts or members.

Longing arms.
It was the nightingale, and not the lark,
That pierc'd the *fearful* hollow of thine ear.
Romeo and Juliet, act iii. ſc. 7.

——————Oh, lay by
Thoſe moſt ungentle looks and angry weapons:
Unleſs you mean my griefs and killing fears
Should ſtretch me out at your *relentleſs* feet.
Fair Penitent, act. iii.

——————And ready now
To ſtoop with *wearied* wing, and *willing* feet,
On the bare outſide of this world.
Paradiſe Loſt, book iii.

5. A quality of the agent given to the inſtrument with which it operates.

Why peep your *coward* ſwords half out their ſhells?

6. An attribute of the agent given to the ſubject upon which it operates.

High-climbing hill. MILTON.

7. A quality of one ſubject given to another.

Ieci, *beatis* nunc Arabum invides
Gazis. HORAT. *Carm.* lib. i. ode 29.

When ſapleſs age, and weak unable limbs,
Should bring thy father to his *drooping* chair.
SHAKESPEARE.

Figure.

By art, the pilot through the boiling deep,
And howling tempeſt, ſteers the *fearleſs* ſhip.
Iliad, book xxiii. l. 385.

Then, nothing loth, th' enamour'd fair he led,
And ſunk tranſported on the *conſcious* bed.
Odyſſey, book viii. l. 337.

A *ſtupid* moment motionleſs ſhe ſtood.
Summer, l. 1336.

8. A circumſtance connected with a ſubject, expreſſed as a quality of the ſubject.

Breezy ſummit.

'Tis ours the chance of *fighting* fields to try,
Iliad, book i. l. 301.

Oh! had I dy'd before that *well-fought* wall.
Odyſſey, book v. l. 395.

From this table it appears, that the adorning a cauſe with an attribute of the effect, is not ſo agreeable as the oppoſite expreſſion. The progreſs from cauſe to effect is natural and eaſy: the oppoſite progreſs reſembles retrograde motion*; and therefore *panting height*, *aſtoniſh'd thought*, are ſtrain'd and uncouth expreſſions, which a writer of taſte will avoid.

† See PERCEPTION and Ideas in a Train.

It is not leſs ſtrained, to apply to a ſubject in its preſent ſtate, an epithet that may belong to it in ſome future ſtate:

Submerſaſque obrue puppes. *Eneid*, book i. l. 73.

And mighty *ruins* fall. *Iliad*, book v. l. 411.

Impious ſons their *mangled* fathers wound.

Another rule regards this figure, That the property of one ſubject ought not to be beſtowed upon another with which the property is incongruous.

K. Rich. ————How dare thy joints forget
To pay their *awful* duty to our preſence?
Richard II. act. iii. ſc. 6.

The connexion between an awful ſuperior and his ſubmiſſive dependent is ſo intimate, that an attribute may readily be transferred from the one to the other: but awfulneſs cannot be ſo transferred, becauſe it is inconſiſtent with ſubmiſſion.

Figure of Speech, as peculiarly diſtinguiſhed from the above and from thoſe firſt referred to.] Under the article *Metaphor and Allegory*, a figure of ſpeech is defined, "The uſing a word in a ſenſe different from what is proper to it;" and the new or uncommon ſenſe of the word is termed *the figurative ſenſe*. The figurative ſenſe muſt have a relation to that which is proper; and the more intimate the relation is, the figure is the more happy. How ornamental this figure is to language, will not be readily imagined by any one who hath not given peculiar attention; and therefore we ſhall endeavour to unfold its capital beauties and advantages. In the firſt place, a word uſed figuratively, or in a new ſenſe, ſuggeſts at the ſame time the ſenſe it commonly bears: and thus it has the effect to preſent two objects; one ſignified by the figurative ſenſe, which may be termed *the principal object*; and one ſignified by the proper ſenſe, which may be termed *acceſſory*: the principal makes a part of the thought; the acceſſory is merely ornamental. In this reſpect, a figure of ſpeech is preciſely ſimilar to concordant ſounds in muſic, which, without contributing to the melody, make it harmonious.

Elem. of Criticiſm.

Figure.

To explain the matter by examples. *Youth*, by a figure of ſpeech, is termed *the morning of life*: This expreſſion ſignifies *youth*, the principal object which enters into the thought; it ſuggeſts, at the ſame time, the proper ſenſe of *morning*; and this acceſſory object, being in itſelf beautiful, and connected by reſemblance to the principal object, is not a little ornamental. *Imperious ocean* is an example of a different kind, where an attribute is expreſſed figuratively: Together with *ſtormy*, the figurative meaning of the epithet *imperious*, where is ſuggeſted its proper meaning, viz. the ſtern authority of a deſpotic prince; and theſe two are ſtrongly connected by reſemblance. Upon this figurative power of words, Vida deſcants with elegance, *Poet.* lib. iii. l. 44.

In the next place, this figure poſſeſſes a ſignal power of aggrandizing an object, by the following means.—Words, which have no original beauty but what ariſes from their ſound, acquire an adventitious beauty from their meaning: a word ſignifying any thing that is agreeable, becomes by that means agreeable; for the agreeableneſs of the object is communicated to its name. This acquired beauty, by the force of cuſtom, adheres to the word even when uſed figuratively; and the beauty received from the thing it properly ſignifies, is communicated to the thing which it is made to ſignify figuratively. Conſider the foregoing expreſſion *Imperious ocean*, how much more elevated it is than *Stormy ocean*.

Thirdly, This figure hath a happy effect by preventing the familiarity of proper names. The familiarity of a proper name is communicated to the thing it ſignifies by means of their intimate connexion; and the thing is thereby brought down in our feeling. This bad effect is prevented by uſing a figurative word inſtead of one that is proper: as for example, when we expreſs the ſky by terming it *the blue vault of heaven*; for though no work of art can compare with the ſky in grandeur, the expreſſion however is reliſhed, becauſe it prevents the object from being brought down by the familiarity of its proper name. With reſpect to the degrading the familiarity of proper names, Vida has the following paſſage:

Hinc ſi dura mihi paſſus dicendus Ulyſſes,
Non illum vero memorabo nomine, ſed qui
Et mores hominum multorum vidit, et urbes,
Naufragus everſæ poſt ſæva incendia Trojæ.
Poet. lib. ii. l. 460.

Laſtly, By this figure, language is enriched, and rendered more copious; in which reſpect, were there no other, a figure of ſpeech is a happy invention. This property is finely touched by Vida; *Poet.* lib. iii. l. 90.

The beauties we have mentioned belong to every figure of ſpeech. Several other beauties, peculiar to one or other ſort, we ſhall have occaſion to remark afterward.

Not only ſubjects, but qualities, actions, effects, may be expreſſed figuratively. Thus, as to ſubjects, *gates of breath* for the lips, *the watery kingdom* for the ocean. As to qualities, *fierce* for ſtormy, in the expreſſion *Fierce winter*; *altus* for profundus, *Altus puteus*, *Altum mare*;

Figure.

mare; breathing for perſpiring, *Breathing plants.* Again, as to actions, The ſea *rages*, Time will *melt* her frozen thoughts, Time *kills* grief. An effect is put for the cauſe, as *lux* for the ſun; and a cauſe for the effect, as *boum labores* for corn. The relation of reſemblance is one plentiful ſource of figures of ſpeech; and nothing is more common than to apply to one object the name of another that reſembles it in any reſpect: Height, ſize, and worldly greatneſs, reſemble not each other; but the emotions they produce reſemble each other, and, prompted by this reſemblance, we naturally expreſs worldly greatneſs by height or ſize: One feels a certain uneaſineſs in ſeeing a great depth; and, hence depth is made to expreſs any thing diſagreeable by exceſs, as *depth* of grief, *depth* of deſpair: Again, Height of place, and time long paſt, produce ſimilar feelings; and hence the expreſſion, *Ut altius repetam!* Diſtance in paſt time, producing a ſtrong feeling, is put for any ſtrong feeling; *Nihil mihi antiquius noſtra amicitia:* Shortneſs with relation to ſpace, for ſhortneſs with relation to time; *Brevis eſſe laboro, obſcurus fio:* Suffering a puniſhment reſembles paying a debt; hence *pendere pœnas.* In the ſame manner, light may be put for glory, ſunſhine for proſperity, and weight for importance.

Many words, originally figurative, having, by long and conſtant uſe, loſt their figurative power, are degraded to the inferior rank of proper terms. Thus the words that expreſs the operation of the mind, have in all languages been originally figurative: the reaſon holds in all, that when theſe operations came firſt under conſideration, there was no other way of deſcribing them but by what they reſembled: it was not practicable to give them proper names, as may be done to objects that can be aſcertained by ſight and touch. A *ſoft* nature, *jarring* tempers, *weight* of woe, *pompous* phraſe, *beget* compaſſion, *aſſuage* grief, *break* a vow, *bend* the eye downward, *ſhower* down curſes, *drowning* in tears, *wrapt* in joy, *warm'd* with eloquence, *loaded* with ſpoils, and a thouſand other expreſſions of the like nature, have loſt their figurative ſenſe. Some terms there are that cannot be ſaid to be altogether figurative or altogether proper: originally figurative, they are tending to ſimplicity, without having loſt altogether their figurative power. Virgil's *Regina faucia cura*, is perhaps one of theſe expreſſions: with ordinary readers, *faucia* will be conſidered as expreſſing ſimply the effect of grief; but one of a lively imagination will exalt the phraſe into a figure.

For epitomizing this ſubject, and at the ſame time for giving a clear view of it, Lord Kames † gives a liſt of the ſeveral relations upon which figures of ſpeech are commonly founded. This liſt he divides into two tables; one of ſubjects expreſſed figuratively, and one of attributes.

† *Elem. of Criticiſm.* ii. 305.

TAB. I. *Subjects expreſſed figuratively.*

1. A word proper to one ſubject employed figuratively to expreſs a reſembling ſubject.

There is no figure of ſpeech ſo frequent, as what is derived from the relation of reſembling. Youth, for example, is ſignified figuratively by the *morning* of life. The life of a man reſembles a natural day in ſeveral particulars: the morning is the beginning of a day, youth the beginning of life; the morning is cheerful, ſo is youth, &c. By another reſemblance, a bold warrior is termed the *thunderbolt* of war; a multitude of troubles, a *ſea* of troubles. Figure.

This figure, above all others, affords pleaſure to the mind by variety of beauties. Beſides the beauties above mentioned, common to all ſorts, it poſſeſſes in particular the beauty of a metaphor or a ſimile: a figure of ſpeech built upon reſemblance, ſuggeſts always a compariſon between the principal ſubject and the acceſſory; whereby every good effect of a metaphor or ſimile may, in a ſhort and lively manner, be produced by this figure of ſpeech.

2. A word proper to the effect employed figuratively to expreſs the cauſe.

Lux for the ſun; *Shadow* for cloud. A helmet is ſignified by the expreſſion *glittering terror;* a tree by *ſhadow* or *umbrage.* Hence the expreſſion,

Nec habet Pelion umbras. OVID.

Where the dun umbrage hangs. *Spring*, l. 1023.

A wound is made to ſignify an arrow:

Vulnere non pedibus te conſequar. OVID.

There is a peculiar force and beauty in this figure: the word which ſignifies figuratively the principal ſubject, denotes it to be a cauſe by ſuggeſting the effect.

3. A word proper to the cauſe employed figuratively to expreſs the effect.

Boumque labores for corn. *Sorrow* or *grief* for tears.

Again Ulyſſes veil'd his penſive head;
Again unmann'd, a ſhow'r of *ſorrow* ſhed.

Streaming *grief* his faded cheek bedew'd.

Blindneſs for darkneſs:

Cæcis erramus in undis. *Æneid.* iii. 200.

There is a peculiar energy in this figure, ſimilar to that in the former: the figurative name denotes the ſubject to be an effect by ſuggeſting its cauſe.

4. Two things being intimately connected, the proper name of the one employed figuratively to ſignify the other.

Day for light, *Night* for darkneſs; and hence, A ſudden night. *Winter* for a ſtorm at ſea:

Interea magno miſceri murmure pontum,
Emiſſamque Hyemem ſenſit Neptunus.
Æneid. i. 128.

This laſt figure would be too bold for a Britiſh writer, as a ſtorm at ſea is not inſeparably connected with winter in this climate.

5. A word proper to an attribute, employed figuratively to denote the ſubject.

Youth and *beauty* for thoſe who are young and beautiful:

Youth and beauty ſhall be laid in duſt.

Majeſty for the king:

What art thou, that uſurp'ſt this time of night,
Together with that fair and warlike form
In which the *Majeſty* of buried Denmark
Did ſometime march? *Hamlet*, act. i. ſc. 1.

Figure.

——Or have ye choſen this place,
After the toils of battle to repoſe
Your weary'd *virtue?* *Paradiſe Loſt.*

Verdure for a green field. *Summer*, l. 301.

Speaking of cranes,

The pigmy nations, wounds and death they bring,
And all the *war* deſcends upon the wing.
Iliad, book iii. l. 10.

Cool *age* advances venerably wiſe.
Iliaa, book iii. l. 149.

The peculiar beauty of this figure ariſes from ſuggeſting an attribute that embelliſhes the ſubject, or puts it in a ſtronger light.

6. A complex term employed figuratively to denote one of the component parts.

Funus for a dead body. *Burial* for a grave.

7. The name of one of the component parts inſtead of the complex term.

Tæda for a marriage. The *Eaſt* for a country ſituated eaſt from us. *Jovis veſtigia ſervat*, for imitating Jupiter in general.

8. A word ſignifying time or place, employed figuratively to denote what is connected with it.

Clime for a nation, or for a conſtitution of government: hence the expreſſion, *Merciful clime*, *Fleecy winter*, for ſnow, *Seculum felix*.

9. A part for the whole.

The *pole* for the earth. The *head* for the perſon:

Triginta minas pro *capite* tuo dedi. PLAUTUS.

Tergum for the man:

Fugiens tergum. OVID.

Vultus for the man:

Jam fulgor armorum fugaces
Terret equos, equitumque vultus. HORAT.

Quis deſiderio ſit pudor aut modus
Tam chari *capitis?* HORAT.

Dumque virent *genua?* HORAT.

Thy growing virtues juſtify'd my cares,
And promis'd comfort to my *ſilver hairs*.
Iliad, book ix. l. 616.

——Forthwith from the pool he rears
His mighty *ſtature*. *Paradiſe Loſt.*

The ſilent *heart* which grief aſſails. PARNEL.

The peculiar beauty of this figure conſiſts in marking that part which makes the greateſt figure.

10. The name of the container, employed figuratively to ſignify what is contained.

Grove for the birds in it; Vocal *grove*. *Ships* for the ſeamen; Agonizing *Ships*. *Mountains* for the ſheep paſturing upon them; Bleating *mountains*. *Zacynthus*, *Ithaca*, &c. for the inhabitants; *Ex mœſtis domibus*. Livy.

11. The name of the ſuſtainer, employed figuratively to ſignify what is ſuſtained.

Altar for the ſacrifice. *Field* for the battle fought upon it; Well-fought *field*.

12. The name of the materials, employed figuratively to ſignify the things made of them.

Ferrum for *gladius*.

13. The names of the Heathen deities, employed figuratively to ſignify what they patronize. Figure.

Jove for the air, *Mars* for war, *Venus* for beauty, *Cupid* for love, *Ceres* for corn, *Neptune* for the ſea, *Vulcan* for fire.

This figure beſtows great elevation upon the ſubject; and therefore ought to be confined to the higher ſtrains of poetry.

TAB. II. *Attributes expreſſed figuratively.*

1. When two attributes are connected, the name of the one may be employed figuratively to expreſs the other.

Purity and virginity are attributes of the ſame perſon: hence the expreſſion, *Virgin* ſnow, for pure ſnow.

2. A word ſignifying properly an attribute of one ſubject, employed figuratively to expreſs a reſembling attribute of another ſubject.

Tottering ſtate. *Imperious* ocean. *Angry* flood. *Raging* tempeſt. *Shallow* fears.

My ſure divinity ſhall bear the ſhield,
And edge thy ſword to *reap* the glorious field.
Odyſſey, book xx. l. 61.

Black omen, for an omen that portends bad fortune.

Ater omen. VIRGIL.

The peculiar beauty of this figure ariſes from ſuggeſting a compariſon.

3. A word proper to the ſubject, employed to expreſs one of its ottributes.

Mens for *intellectus*. *Mens* for a reſolution:

Iſtam, oro, exue mentem.

4. When two ſubjects have a reſemblance by a common quality, the name of the one ſubject may be employed figuratively to denote that quality in the other:

Summer life for agreeable life.

5. The name of the inſtrument made to ſignify the power of employing it:

——Melpomene, cui liquidam pater
Vocem cum *cithara* dedit.

The ample field of figurative expreſſion diſplayed in theſe tables, affords great ſcope for reaſoning. Several of the obſervations relating to metaphor†, are applicable to figures of ſpeech: theſe ſhall be ſlightly retouched, with ſome additions peculiarly adapted to the preſent ſubject. † See *Metaphor*.

1. As the figure under conſideration is built upon relation, we find from experience, and it muſt be obvious from reaſon, that the beauty of it depends on the intimacy of the relation between the figurative and proper ſenſe of the word. A ſlight reſemblance, in particular, will never make this figure agreeable: the expreſſion, for example, *Drink down a ſecret*, for liſtening to a ſecret with attention, is harſh and uncouth, becauſe there is ſcarce any reſemblance between *liſtening* and *drinking*. The expreſſion *weighty crack*, uſed by Ben Johnſon for *loud crack*, is worſe if poſſible; a loud ſound has not the ſlighteſt reſemblance to a piece of matter that is weighty.

Phemius! let acts of gods, and heroes old,
What ancient bards in hall and bow'r have told,

Attemper'd

Figure.

Attemper'd to the lyre, your voice employ,
Such the pleas'd *ear will drink* with ſilent joy.
Odyſſey, book i. l. 433.

Strepitumque exterritus *hauſit*.
Æneid, book vi. l. 559.

——————————Write, my queen,
And with mine eyes I'll *drink* the words you ſend.
Cymbeline, act i. ſc. 2.

As thus th' effulgence tremulous I *drink*.
Summer, l. 1684.

Neque *audit* currus habenas.
Georg. book i. l. 514.

O prince! (Lycaon's valiant ſon reply'd),
As thine the ſteeds, be thine the taſk to guide.
The horſes practis'd to their lord's command,
Shall *hear* the rein, and anſwer to thy hand.
Iliad, book v. l. 288.

The following figures of ſpeech ſeem altogether wild and extravagant, the figurative and proper meaning having no connexion whatever. *Mowing* ſoftneſs, Freſhneſs *breathes*, *Breathing* proſpect, *Flowing* ſpring, *Dewy* light, *Lucid* coolneſs, and many others of this falſe coin, may be found in Thomſon's *Seaſons*.

2. The proper ſenſe of the word ought to bear ſome proportion to the figurative ſenſe, and not ſoar much above it, nor ſink much below it. This rule, as well as the foregoing, is finely illuſtrated by Vida, *Poet.* book iii. l. 148.

3. In a figure of ſpeech, every circumſtance ought to be avoided that agrees with the proper ſenſe only, not with the figurative ſenſe: for it is the latter that expreſſes the thought, and the former ſerves for no other purpoſe but to make harmony:

Zacynthus green with ever-ſhady groves,
And Ithaca, preſumptuous boaſt their loves;
Obtruding on my choice a ſecond lord,
They preſs the Hymenean rite abhorr'd.
Odyſſey, book xix. l. 152.

Zacynthus here ſtanding figuratively for the inhabitants, the deſcription of the iſland is quite out of place: it puzzles the reader, by making him doubt whether the word ought to be taken in its proper or figurative ſenſe.

——————————Write, my queen,
And with mine eyes I'll drink the words you ſend,
Though ink be made of gall.
Cymbeline, act. i. ſc. 2.

The diſguſt one has to drink ink in reality, is not to the purpoſe where the ſubject is drinking ink figuratively.

4. To draw conſequences from a figure of ſpeeeh, as if the word were to be underſtood literally, is a groſs abſurdity; for it is confounding truth with fiction:

Be Moubray's ſins ſo heavy in his boſom,
That they may break his foaming courſer's back,
And throw the rider headlong in the liſts,
A caitiff recreant to my couſin Hereford.
Richard II. act. i. ſc. 3.

Sin may be imagined heavy in a figurative ſenſe: but weight in a proper ſenſe belongs to the acceſſory only; and therefore to deſcribe the effects of weight, is to deſert the principal ſubject, and to convert the acceſſory into a principal: Figure.

Cromwell. How does your Grace?
Wolſey. Why, well;
Never ſo truly happy, my good Cromwell.
I know myſelf now, and I feel within me
A peace above all earthly dignities,
A ſtill and quiet conſcience. The king has cur'd me,
I humbly thank his Grace: and, from theſe ſhoulders,
Theſe ruin'd pillars, out of pity, taken
A load would ſink a navy, too much honour.
Henry VIII. act. iii. ſc. 6.

Ulyſſes ſpeaking of Hector—

I wonder now how yonder city ſtands,
When we have here the baſe and pillar by us.
Troilus and Creſſida, Act. iv. Sc. 9.

Othello. No; my heart is turned to ſtone: I ſtrike it, and it hurts my hand. *Othello*, act. iv. ſc. 5.

Not leſs, even in this deſpicable now,
Than when my name fill'd Afric with affrights,
And froze your hearts beneath your torrid zone.
Don Sebaſtian King of Portugal, act. i.

How long a ſpace, ſince firſt I lov'd, it is!
To look into a glaſs I fear,
And am ſurpris'd with wonder, when I miſs
Gray hairs and wrinkles there.
COWLEY, vol. i. p. 86.

I choſe the flouriſhing'ſt tree in all the park,
With freſheſt boughs and faireſt head;
I cut my love into its gentle bark,
And in three days behold 'tis dead;
My very written flames ſo violent be,
They've burnt and wither'd up the tree.
COWLEY, vol. i. p. 136.

Ah, mighty Love, that it were inward heat
Which made this precious limbeck ſweat!
But what, alas! ah, what does it avail,
That ſhe weeps tears ſo wond'rous cold,
As ſcarce the aſs's hoof can hold,
So cold, that I admire they fall not hail!
COWLEY, vol. i. p. 132.

Such a play of words is pleaſant in a ludicrous poem.

Almeria. O Alphonſo, Alphonſo!
Devouring ſeas have waſh'd thee from my ſight,
No time ſhall raze thee from my memory;
No, I will live to be thy monument:
The cruel ocean is no more thy tomb;
But in my heart thou art interr'd.
Mourning Bride, act i. ſc. 1.

This would be very right, if there were any inconſiſtence in being interred in one place really, and in another place figuratively.

From conſidering, that a word uſed in a figurative ſenſe ſuggeſts at the ſame time its proper meaning, we diſcover a fifth rule, That we ought not to employ a word in a figurative ſenſe, the proper ſenſe of which is inconſiſtent or incongruous with the ſubject: for every inconſiſtency, and even incongruity, though in the expreſſion only and not real, is unpleaſant:

Interea

Figure.

Interea genitor Tyberini ad fluminis undam,
Vulnera *ficcabat* lymphis———————

Æneid, book x. l. 833.

Tres adeo incertos cæca caligine *soles*
Erramus pelago, totidem fine ſidere noctes.

Æneid, book iii. l. 203.

The foregoing rule may be extended to form a ſixth, That no epithet ought to be given to the figurative ſenſe of a word that agrees not alſo with its proper ſenſe:

———————Dicat Opuntiæ
Frater Megillæ, quo *beatus*
Vulnere. HORAT. *Carm.* lib. i. ode 27.

Parcus deorum cultor, et infrequens,
Inſanientis dum ſapientiæ
Conſultus erro. HORAT. *Carm.* lib. i. ode 54.

Seventhly, The crowding into one period or thought different figures of ſpeech, is not leſs faulty than crowding metaphors in that manner: the mind is diſtracted in the quick tranſition from one image to another, and is puzzled inſtead of being pleaſed:

I am of ladies moſt deject and wretched,
That ſuck'd the honey of his muſic vows. *Hamlet.*

My bleeding boſom ſickens at the ſound.

Odyſſey, book i. l. 439.

———————Ah miſer,
Quanta laboras in *Charybdi!*
Digne puer meliore *flamma.*
Quæ ſaga, quis te ſolvere Theſſalis
Magus *venenis*, qua poterit Deus:
Vix illigatum tetriformi
Pegaſus expediet *Chimera.*

HORAT. *Carm.* lib. i. ode 27.

Eighthly, If crowding figures be bad, it is ſtill worſe to graft one figure upon another: For inſtance,

While his keen falchion drinks the warriors lives.

Iliad, book xi. l. 211.

A falchion drinking the warriors blood, is a figure built upon reſemblance, which is paſſable. But then in the expreſſion, *lives* is again put for *blood*; and by thus grafting one figure upon another, the expreſſion is rendered obſcure and unpleaſant.

Ninthly, Intricate and involved figures, that can ſcarce be analyzed, or reduced to plain language, are leaſt of all tolerable:

Votis incendimus aras. *Æneid*, book iii. l. 279.

———————Onerentque caniſtris
Dona laboratæ Cereris *Æneid*, book viii. l. 180.

Vulcan to the Cyclops:

Arma acri facienda viro: nunc viribus uſus,
Nunc manibus rapidis, omni nunc arte magiſtra:
Præcipitate moras. *Æneid*, book viii. l. 441.

———————Huic gladio, perque ærea ſcuta,
Per tunicam ſqualentem auro, latus *haurit* apertum.

Æneid, book x. l. 313.

Scriberis Vario fortis, et hoſtium
Victor, Mæonii carminis *alite.*

HORAT. *Carm.* lib. i. ode 6.

Eiſe ſhall our fates be number'd with the dead. Figure.

Iliad, book v. l. 294.

Commutual death the fate of war confounds.

Iliad, book viii. l. 85, and book xi. l. 117.

Speaking of Proteus.

Inſtant he wears, eluſive of the rape,
The mimic force of every ſavage ſhape.

Odyſſey, book iv. l. 563.

Rolling convulſive on the floor, is ſeen
The piteous object of a proſtrate queen.

Ibid. book iv. l. 652.

The mingling tempeſt weaves its gloom.

Autumn, l. 337.

A various ſweetneſs ſwells the gentle race.

Ibid. l. 640.

The diſtant waterfall ſwells in the breeze.

Winter, l. 738.

In the tenth place, When a ſubject is introduced by its proper name, it is abſurd to attribute to it the properties of a different ſubject to which the word is ſometimes applied in a figurative ſenſe:

Hear me, Oh Neptune! thou whoſe arms are hurl'd
From ſhore to ſhore, and gird the ſolid world.

Odyſſey, book ix. l. 617.

Neptune is here introduced perſonally, and not figuratively, for the ocean: the deſcription therefore, which is only applicable to the latter, is altogether improper.

It is not ſufficient that a figure of ſpeech be regularly conſtructed, and be free from blemiſh: it requires taſte to diſcern when it is proper, when improper; and taſte perhaps is our only guide. One, however, may gather from reflections and experience, that ornaments and graces ſuit not any of the diſpiriting paſſions, nor are proper for expreſſing any thing grave and important. In familiar converſation, they are in ſome meaſure ridiculous: Proſpero, in the *Tempeſt*, ſpeaking to his daughter Miranda, ſays,

The fringed curtains of thine eyes advance,
And ſay what thou ſeeſt yond.

No exception can be taken to the juſtneſs of the figure; and circumſtances may be imagined to make it proper: but it is certainly not proper in familiar converſation.

In the laſt place, Though figures of ſpeech have a charming effect when accurately conſtructed and properly introduced, they ought, however, to be ſcattered with a ſparing hand; nothing is more luſcious, and nothing conſequently more ſatiating, than redundant ornaments of any kind.

FIGURE is uſed, in *Theology*, for the myſteries repreſented or delivered obſcurely to us under certain types, or actions in the Old Teſtament. Thus manna is held a figure or type of the euchariſt; and the death of Abel a figure of the ſuffering of Chriſt.

Many divines and critics contend, that all the actions, hiſtories, ceremonies, &c. of the Old Teſtament, are only figures, types, and prophecies, of what was to happen under the New. The Jews are ſuppoſed

Figure || Filaments.

to have had the figures or ſhadows, and we the ſubſtance.

FIGURE is alſo applied in a like ſenſe to profane matters; as the emblems, enigmas, fables, ſymbols, and hieroglyphics, of the ancients.

FIGURED, in general, ſomething marked with figures.

The term *figured* is chiefly applied to ſtuffs, whereon the figures of flowers, and the like, are either wrought or ſtamped.

FIGURED, in *Muſic*, is applied either to ſimple notes or to harmony: to ſimple notes, as in theſe words *figured baſs*, to expreſs a baſs whoſe notes carrying chords are ſubdivided into many other notes of leſſer value: to harmony, when, by ſuppoſition and in a diatonic procedure, other notes than thoſe which form the chord are employed. See SUPPOSITION.

To *figure* is to paſs ſeveral notes for one; to form runnings or variations; to add ſome notes to the air, in whatever manner it be done; in ſhort, it is to give to harmonious ſounds a figure of melody, by connecting them with other intermediate ſounds.

FILAGO, a genus of plants, belonging to the ſyngeneſia claſs; and in the natural method ranking under the 49th order, *Compoſitæ*. See BOTANY *Index*.

FILAMENT, in *Anatomy*, *Natural Hiſtory*, &c. a term uſed in the ſame ſenſe with fibre, for thoſe fine threads whereof the fleſh, nerves, ſkin, plants, roots, &c. are compoſed. See FIBRE.

Vegetable FILAMENTS form a ſubſtance of great uſe in the arts and manufactures; furniſhing thread, cloth, cordage, &c.

For theſe purpoſes the filamentous parts of the *Cannabis* and *Linum*, or hemp and flax, are employed among us †. But different vegetables have been employed in different countries for the ſame uſes. Putrefaction deſtroys the pulpy or fleſhy matter, and leaves the tough filaments entire: By putrefying the leaf of a plant in water, we obtain the fine flexile fibres, which conſtituted the baſis of the ribs and minute veins, and which now form as it were a ſkeleton of the leaf. Alkaline lixivia, in ſome degree, produce ſimilar effects to putrefaction.

† See *Hemp* and *Flax*.

The Sieur de Flacourt, in his hiſtory of Madagaſcar, relates, that different kinds of cloth are prepared in that iſland from the filaments of the bark of certain trees boiled in ſtrong lye; that ſome of theſe cloths are very fine, and approach to the ſoftneſs of ſilk, but in durability come ſhort of cotton; that others are coarſer and ſtronger, and laſt thrice as long as cotton; and that of theſe the ſails and cordage of his veſſel were made. See alſo the article BARK.

The ſame author informs us, that the ſtalks of nettles are uſed for the like purpoſes in his own country, France. And Sir Hans Sloane relates, in one of his letters to Mr Ray, that he has been informed by ſeveral, that muſlin and callico, and moſt of the Indian linens, are made of nettles.

In ſome of the Swediſh provinces, a ſtrong kind of cloth is ſaid to be prepared from hop ſtalks: and in the tranſactions of the Swediſh Academy for the year 1750, there is an account of an experiment made in conſequence of that report. Of the ſtalks, gathered in autumn, about as many were taken as equalled in bulk a quantity of flax that would have produced a pound after preparation. The ſtalks were put into water, and kept covered therewith during the winter. In March they were taken out, dried in a ſtove, and dreſſed as flax. The prepared filaments weighed nearly a pound, and proved fine, ſoft, and white: They were ſpun and woven into ſix ells of fine ſtrong cloth. The author, Mr Shiſler, obſerves, that hop ſtalks take much longer time to rot than flax; and that, if not fully rotted, the woody part will not ſeparate, and the cloth will neither prove white nor fine. Filaments.

Hemp, flax, and all other vegetable filaments, and thread or cloth prepared from them, differ remarkably from wool, hair, ſilk, and other animal productions, not only in the principles into which they are reſoluble by fire, but likewiſe in ſome of their more intereſting properties, particularly in their diſpoſition to imbibe colouring matters; ſundry liquors, which give a beautiful and durable dye to thoſe of the animal, giving no ſtain at all to thoſe of the vegetable kingdom.

A ſolution of copper in aquafortis, which had been changed blue by an addition of volatile ſpirit, on being mixed with a little ſolution of tin, became turbid and greeniſh. Pieces of white ſilk and flannel boiled, without any previous preparation, in this mixture, received a bright deep yellow dye; whilſt pieces of linen, prepared and unprepared, came out as colourleſs as they were put in.

Fiſhing nets are uſually boiled with oak bark or other like aſtringents, which render them more laſting. Thoſe made of flax receive from this decoction a brownish colour, which, by the repeated alternations of water and air, is in a little time diſcharged, whilſt the fine gloſſy brown, communicated by the ſame means to ſilken nets, permanently reſiſts both the air and water, and ſtands as long as the animal filaments themſelves. In like manner the ſtain of ink, or the black dye from ſolutions of iron, mixed with vegetable aſtringents, proves durable in ſilk and woollen; but from linen, the aſtringent matter is extracted by waſhing, and only the yellow iron mould remains,

The red decoction of cochineal, which, heightened with a little ſolution of tin, gives the fiery ſcarlet dye to wool or ſilk that have been previouſly impregnated with ſolution of tartar, makes no impreſſion upon linen or cotton prepared in the ſame manner. M. du Fay informs us, in the Memoirs of the French Academy for the year 1737, that having prepared a mixed cloth whoſe warp was of wool and the woof of cotton, and thoroughly blended the two together by fulling, he ſtill found the cotton to reſiſt the action of the ſcarlet liquor, and the wool to receive the ſame colour from it as wool by itſelf, the ſtuff coming out all over marbled fiery and white.

Many other inſtances of this kind are known too well to the callico printer; whoſe grand deſideratum it is, to find means of making linen receive the ſame colours that wool does. The phyſical cauſe of the difference is wholly unknown; and indeed, of the theory of dyes in general, we know as yet extremely little. (See DYEING.) Are animal filaments tubular, and the colouring atoms received within them? Are vegetable filaments ſolid, and the colour depoſited on the ſurface? Or, does not their different ſuſceptibility of colour depend rather on the different intrinſic properties of the two? There are many inſtances of a like diverſity, even

in

Filaments || File.

in the metallic kingdom, where a mechanical difference in texture can ſcarcely be preſumed to be the cauſe: Thus ſilver receives a deep ſtain from ſulphureous or putrid vapours, or the yolk of a boiled egg, which have no effect upon tin.

FILAMENTS, among botaniſts. See BOTANY *Index*.

FILANDERS, in falconry, a diſeaſe in hawks, &c. conſiſting of filaments or ſtrings of blood coagulated; and occaſioned by a violent rupture of ſome vein, by which the blood, extravaſating, hardens into theſe figures, and incommodes the reins, hips, &c.

FILANDERS, are alſo worms as ſmall as thread, and about an inch long, that lie wrapt up in a thin ſkin or net, near the reins of a hawk, apart from either gut or gorge.

This malady is known by the hawk's poverty; by ruffling her tail; by her ſtraining the fiſt, or perch, with her pounces; and laſtly, by croaking in the night, when the filanders prick her. The diſeaſe proceeds from bad food; and muſt be remedied in time, to prevent its ſpreading over the whole body, and deſtroying the bird. Theſe muſt not be killed as other worms are, for fear of impoſthumes from their corruption, being incapable of paſſing away with the hawk's meat. They muſt only be ſtupified, to prevent their being offenſive; and this is done by giving the hawk a clove of garlic, after which ſhe will feel nothing of the filanders for 40 days. It will be prudent in the falconer, when he obſerves the hawk poor and low, to give her a clove of garlic once a month by way of prevention.

FILBERT, or FILBERD, the fruit of the corylus, or hazel. See CORYLUS, BOTANY *Index*.

FILE, among mechanics, a tool uſed in metal, &c. in order to ſmooth, poliſh, or cut.

This inſtrument is of iron or forged ſteel, cut in little furrows, with chiſſels and a mallet, this and that way, and of this or that depth, according to the grain or touch required. After cutting the file, it muſt be tempered with a compoſition of chimney foot, very hard and dry, diluted and wrought up with urine, vinegar, and ſalt, the whole being reduced to the conſiſtence of muſtard. Tempering the files conſiſts in rubbing them over with this compoſition, and covering them in loam; after which they are put in a charcoal fire, and taken out by that time they have acquired a cherry colour, which is known by a ſmall rod of the ſame ſteel put in along with them. Being taken out of the fire, they are thrown into cold ſpring water; and, when cold, they are cleaned with charcoal and a rag; and being clean and dry, are kept from ruſt by laying them up in wheat bran. Iron files require more heating than ſteel ones. Files are of different forms, ſizes, cuts, and degrees of fineneſs, according to the different uſes and occaſions for which they are made. See FILING.

FILE, in the art of war, a row of ſoldiers, ſtanding one behind another, which is the depth of the battalion or ſquadron. The files of a battalion of foot are generally three deep; as are ſometimes thoſe of a ſquadron of horſe. The files muſt be ſtraight and parallel one to another.

FILE, in *Law*, a thread, ſtring, or wire, upon which writs and other exhibits in courts and offices are faſtened or filed, for the more ſafe keeping, and ready turning to the ſame. A file is a record of the court; and the filing of a proceſs of a court makes it a record of it. An original writ may be filed after judgement given in the cauſe, iſſued forth before; declarations, &c. are to be filed, and affidavits muſt be filed, ſome before they are read in court, and ſome preſently when read in court. Before filing a record removed by *certiorari*, the juſtices of B. R. may refuſe to receive it, if it appears to be for delay, &c.; and remand it back for the expedition of juſtice: but if the *certiorari* be once filed, the proceedings below cannot be revived. An indictment, &c. cannot be amended after it is filed. Filial.

FILIAL, ſomething belonging to the relation of ſon. See SON.

The divines uſually diſtinguiſh between a *ſervile* and a *filial* fear. The moſt abandoned may have a ſervile fear of God, ſuch as that of a ſlave to his maſter; but not a filial fear, i. e. a fear reſulting from love and reſpect. See FEAR.

FILIAL Piety, the affectionate attachment of children to their parents; including in it love, reverence, obedience, and relief. Theſe are duties prompted equally by nature and by gratitude, independent of the injunctions of religion. For where ſhall we find the perſon who hath received from any one benefits ſo great or ſo many, as children from their parents? And it may be truly ſaid, that if perſons are undutiful to their parents, they ſeldom prove good to any other relation. Profane hiſtory furniſhes many fine examples of this amiable virtue; a few of which we ſhall ſelect, according to the plan obſerved in other ſimilar articles.

1. The Roman dictator T. Manlius having exerciſed great cruelty over the citizens, was cited at the expiration of his office to anſwer for his conduct. Among other things that were laid to his charge, he was accuſed of treating with barbarity one of his own ſons. Manlius, according to Livy, had no other cauſe of complaint againſt this ſon than his having an impediment in his ſpeech. For this reaſon he was baniſhed far from the city, from his home, and the company of thoſe of his own age and fortune, and condemned to ſervile works. All were highly exaſperated againſt ſuch inhuman conduct, except the ſon himſelf, who, under the greateſt concern that he ſhould furniſh matter of accuſation againſt his father, reſolved upon a moſt extraordinary method to relieve him. One morning, without appriſing any body, he came to the city armed with a dagger, and went directly to the houſe of the tribune Pomponius, who had accuſed his father. Pomponius was yet in bed. Young Manlius ſent up his name, and was immediately admitted by the tribune, who did not doubt but he was come to diſcover to him ſome new inſtances of his father's ſeverity. But Manlius, as ſoon as he was left alone with the tribune, drew out his dagger, and preſented it to his breaſt; declaring he would ſtab him that moment if he did not ſwear in the form he ſhould dictate, "Never to hold the aſſembly of the people for accuſing his father." Pomponius, who ſaw the dagger glittering at his breaſt, himſelf alone without arms, and attacked by a robuſt young man, full of a bold confidence in his own ſtrength, took the oath demanded of him; and afterwards confeſſed with a kind of complacency in the thing, and a ſincerity which ſufficiently *Liv.* l. 7. c. 4. 5.

Filial. ciently argued he was not ſorry for what he had done, that it was that violence which obliged him to deſiſt from his deſign.

2. Among the multitude of perſons who were proſcribed under the ſecond triumvirate of Rome, were the celebrated orator Cicero and his brother Quintus. The fate of the former, in endeavouring to make his eſcape, is related under the article CICERO. The latter found means to conceal himſelf ſo effectually at home, that the ſoldiers could not find him. Enraged at their diſappointment, they put his ſon to the torture, in order to make him diſcover the place of his father's concealment; but filial affection was proof againſt the moſt exquiſite torments. An involuntary ſigh, and ſometimes a deep groan, was all that could be extorted from the youth. His agonies were increaſed; but with amazing fortitude he ſtill perſiſted in his reſolution of not betraying his father. Quintus was not far off; and it may be imagined better than can be expreſſed, how his heart muſt have been affected with the ſighs and groans of a ſon expiring in tortures to ſave his life. He could bear it no longer; but quitting the place of his concealment, he preſented himſelf to the aſſaſſins, begging of them to put him to death, and diſmiſs the innocent youth, whoſe generous behaviour the triumvirs themſelves, if informed of the fact, would judge worthy of the higheſt approbation. But the inhuman monſters, without being the leaſt affected with the tears either of the father or the ſon, anſwered, that they both muſt die; the father becauſe he was proſcribed, and the ſon becauſe he had concealed his father. Then a new conteſt of tenderneſs aroſe who ſhould die firſt; but this the aſſaſſins ſoon decided, by beheading them both at the ſame time.—This anecdote is related by Appian, Dio, Plutarch, Valerius Maximus, and other hiſtorians.

Plut. in vita Pomp. 3. Cinna, who ſcrupled no attempt, how atrocious ſoever, which could ſerve his purpoſe, undertook to get Pomponius Strabo murdered in his tent; but his ſon ſaved his life, which was the firſt remarkable action of Pompey the Great. The treacherous Cinna, by many alluring promiſes, had gained over one Terentius, a confidant of Pompey's, and prevailed on him to aſſaſſinate the general, and ſeduce his troops. Young Pompey being informed of this deſign a few hours before it was to be put in execution, placed a faithful guard round the prætorium; ſo that none of the conſpirators could come near it. He then watched all the motions of the camp, and endeavoured to appeaſe the fury of the ſoldiers, who hated the general his father, by ſuch acts of prudence as were worthy of the oldeſt commanders. However, ſome of the mutineers having forced open one of the gates of the camp, in order to deſert to Cinna, the general's ſon threw himſelf flat on his back in their way, crying out, that they ſhould not break their oath and deſert their commander, without treading his body to death. By this means he put a ſtop to their deſertion, and afterwards wrought ſo effectually upon them by his affecting ſpeeches and engaging carriage, that he reconciled them to his father.

4. Olympias, Alexander's own mother, was of ſuch an unhappy diſpoſition, that he would never allow her to have any concern in the affairs of the government. *Q. Curtius.* She uſed frequently to make very ſevere complaints on that account; but he always ſubmitted to her ill humour with great mildneſs and patience. Antipater, one of his friends, having one day written a long letter againſt her to the king then abſent, the latter, after reading it, replied, "Antipater does not know that one ſingle tear ſhed by a mother will obliterate ten thouſand ſuch letters as this." A behaviour like this, and ſuch an anſwer, ſhow at one and the ſame time, that Alexander was both an affectionate ſon and an able politician. Filial.

5. Epaminondas is univerſally acknowledged to have been one of the greateſt generals and one of the beſt men which Greece ever produced. Before him the city of Thebes was not diſtinguiſhed by any memorable action, and after him it was not famous for its virtues, but its misfortunes, till it ſunk into its original obſcurity; ſo that it ſaw its glory take birth and expire with this great man. The victory he obtained at Leuctra had drawn the eyes and admiration of all the neighbouring people upon Epaminondas, who looked upon him as the ſupport of Thebes, as the triumphant conqueror of Sparta, as the deliverer of Greece: in a word, as the greateſt man, and the moſt excellent captain, that ever was in the world. In the midſt of this univerſal applauſe, ſo capable of making the general of an army forget the man for the victor, Epaminondas, little ſenſible to ſo affecting and ſo deſerved a glory, "My joy (ſaid he) ariſes from my ſenſe of that which the news of my victory will give my father and my mother."

6. Among an incredible number of illuſtrious perſons who were falſely accuſed and put to death by Nero, was one Bareas Soranus; a man, as Tacitus informs us, of ſingular vigilance and juſtice in the diſcharge of his duty. During his confinement, his daughter Servilia was apprehended and brought into the ſenate, and there arraigned. The crime laid to her charge was, that ſhe had turned into money all her ornaments and jewels, and the moſt valuable part of her dreſs, to defray the expence of conſulting magicians. To this the young Servilia, with tears, replied, That ſhe had indeed conſulted magicians, but the whole of her inquiry was to know whether the emperor and ſenate would afford protection and ſafety to her dear and indulgent parent againſt his accuſers. "With this view (ſaid ſhe) I preſented the diviners, men till now utterly unknown to me, with my jewels, apparel, and the other ornaments peculiar to my quality, as I would have preſented my blood and life, could my blood and life have procured my father's liberty. But whatever this my proceeding was, my unfortunate father was an utter ſtranger to it; and if it is a crime, I alone am the delinquent." She was, however, together with her father, condemned to die; but in what manner, hiſtory is ſilent. [Vid. *Taciti Annales*, lib. vi. cap. 20.]

7. Valerius Maximus † likewiſe relates a very ſingular fact upon this ſubject. A woman of illuſtrious birth had been condemned to be ſtrangled. The Roman prætor delivered her up to the triumvir, who cauſed her to be carried to priſon, in order to her being put to death. The gaoler, who was ordered to execute her, was ſtruck with compaſſion, and could not reſolve to kill her. He choſe therefore to let her die of hunger. Beſides which, he ſuffered her daughter

† Lib. v. 4. *Plinii Hiſt.* lib. vii. 30.

Filibeg, Filing.

to see her in prison; taking care, however, that she brought her nothing to eat. As this continued many days, he was surprised that the prisoner lived so long without eating; and suspecting the daughter, upon watching her, he discovered that she nourished her mother with her own milk. Amazed at so pious, and at the same time so ingenious an invention, he told the fact to the triumvir, and the triumvir to the prætor, who believed the thing merited relating in the assembly of the people. The criminal was pardoned, and a decree was passed that the mother and daughter should be subsisted for the rest of their lives at the expence of the public.

The same author gives a similar instance of filial piety in a young woman named Xantippe to her aged father Cimonus, who was likewise confined in prison, and which is universally known by the name of the *Roman Charity*. Both these instances appeared so very extraordinary and uncommon to that people, that they could only account for them, by supposing that the love of children to their parents was the first law of nature. *Putaret aliquis* (says our author) *hoc contra naturam factum esse, nisi prima naturæ lex esset diligere parentes.*

In addition to the foregoing examples, we may refer to the article ÆTNA, where a very noble instance of filial piety is taken notice of. See also the article PIETAS.

FILIBEG, or PHILIBEG. See PHILIBEG.

FILICACIA, VINCENT, a celebrated Italian poet, was born at Florence in 1642. He was a member of the Academy della Crusca and of that of the Arcadi, and became secretary to the duke of Tuscany. He died in 1707. His poems are much esteemed for the delicacy and nobleness of their sentiments. Scipio de Filicacia, his son, had them all printed together, under the title of *Poesie Fosiano di Vicenzo da Filicacia*, in 1707, 4to.

FILICES, (from *filum* "a thread," *quasi filatim incisa*), FERNS; one of the seven tribes or families of the vegetable kingdom, according to Linnæus, by whom it is thus characterized: "having their fructification on the back side of the frondes." They constitute the first order in the class cryptogamia; and consist of 16 genera, which are divided into *fructificationes, spicatæ, frondosæ, et radicales.* This order comprehends the entire 16th class of Tournefort, in whose system the filices make only a single genus, in the first section of the above-mentioned class.

FILICES, is also an order of plants in the *fragmenta methodi naturalis* of Linnæus. See BOTANY *Index.*

FILIGRANE, FILIGREE, or FILLAGREE, *Work.* See FILLAGREE.

FILING, one of the principal operations in smithery, &c. succeeding to forging. See FILE.

The coarser cut files are always to be succeeded by finer; and in all the kinds the rule is, to lean heavy on the file in thrusting it forward, because the teeth of the file are made to cut forwards. But in drawing the file back again for a second stroke, it is to be lightly lifted just above the work, by reason it cuts not coming back.

The rough or coarse-toothed file (which, when large, is called a *rubber*) serves to take off the unevenesses of the work, left by the hammer in forging.

Filipendula || Fillagree.

The bastard-toothed file is to take out too deep cuts, and file strokes made by the rough file. The fine-toothed file takes out the cuts or file-strokes the bastard file made; and the smooth file those left by the fine file.

In this order, the files of several cuts are to succeed each other till the work is as smooth as it can be filed. After which it may be made yet smoother with emery, tripoli, &c. See POLISHING.

FILIPENDULA, DROPWORT, a species of spiræa. See SPIRÆA, BOTANY *Index.*

FILIX, FERN. See FILICES, BOTANY *Index.*

FILLAGREE, FILIGREE, or FILIGRANE, *Work*, a kind of enrichment on gold or silver, wrought delicately, in manner of little threads or grains, or both intermixed. The word is compounded of *fil* or *filum*, "thread," and *granum*, "grain." In Latin it is called *filatim elaboratum opus, argentum, aurum.*

There is no manufacture in any part of the world, that has been more admired and celebrated, than the fine gold and silver fillagree of Sumatra. And what renders it a matter of greater curiosity is the coarseness of the tools employed in the workmanship, and which, in the hands of an European, would not be thought sufficiently perfect for the most ordinary purposes.—They are rudely and inartificially formed, by the goldsmith (*pandi*) from any old iron he can pick up. When you engage one of them to execute a piece of work, his first request is usually for a piece of iron hoop, to make his wire-drawing instrument; an old hammer head, stuck in a block, serves for an anvil; and a pair of compasses is often composed of two old nails tied together at one end. The gold is melted in a piece of a *preeoo* or earthen rice-pot, or sometimes in a crucible of their own make, of ordinary clay. In general they use no bellows, but blow the fire with their mouths, through a joint of bamboo; and if the quantity of metal to be melted is considerable, three or four persons sit round their furnace, which is an old broken quallee or iron pot, and blow together. At Padang alone, where the manufacture is more considerable, they have adopted the Chinese bellows. Their method of drawing the wire differs but little from that used by European workmen. When drawn to a sufficient fineness, they flatten it by beating it on their anvil; and when flattened, they give it a twist like that in the whalebone handle of a punch ladle, by rubbing it on a block of wood with a flat stick. After twisting they again beat it on the anvil, and by these means it becomes flat wire with indented edges. With a pair of nippers they fold down the end of the wire, and thus form a leaf, or element of a flower in their work, which is cut off. The end is again folded and cut off, till they have got a sufficient number of leaves, which are all laid on singly. Patterns of the flowers or foliage, in which there is not very much variety, are prepared on paper, of the size of the gold plate on which the fillagree is to be laid. According to this, they begin to dispose on the plate the larger compartments of the foliage, for which they use plain flat wire of a larger size, and fill them up with the leaves before mentioned. To fix the work, they employ a gelatinous substance, made of the red-hot berry called *boca sago*, ground to a pulp on a rough stone. This pulp they place on a young

Marsden's Account of Sumatra, p. 141.

Fillagree, Fillet.

young cocoa nut about the ſize of a walnut, the top and bottom being cut off. After the leaves have been all placed in order, and ſtuck on, bit by bit, a ſolder is prepared of gold filings and borax, moiſtened with water, which they ſtrew over the plate; and then putting it in the fire for a ſhort time, the whole becomes united. This kind of work on a gold plate, they call *carrang pajan*: when the work is open, they call it *carrang trouſe*. In executing the latter, the foliage is laid out on a card, or ſoft kind of wood, and ſtuck on, as before deſcribed, with the ſago berry; and the work, when finiſhed, being ſtrewed over with their ſolder, is put into the fire, when the card or ſoft wood burning away, the gold remains connected. If the piece be large, they ſolder it at ſeveral times. In the manufacture of badjoo buttons, they firſt make the lower part flat, and having a mould formed of a piece of buffalo's horn, indented to ſeveral ſizes, each like one half of a bullet mould, they lay their work over one of theſe holes, and with a horn punch they preſs it into the form of the button. After this they complete the upper part. When the fillagree is finiſhed, they cleanſe it, by boiling it in water with common ſalt and alum, or ſometimes lime juice; and in order to give it that fine purple colour which they call *ſapo*, they boil it in water with brimſtone. The manner of making the little balls with which their works are ſometimes ornamented, is as follows: They take a piece of charcoal, and having cut it flat and ſmooth, they make in it a ſmall hole, which they fill with gold duſt, and this melted in the fire becomes a little ball. They are very inexpert at finiſhing and poliſhing the plain parts, hinges, ſcrews, and the like, being in this as much excelled by the European artiſts, as theſe fall ſhort of them in the fineneſs and minuteneſs of the foliage. The Chineſe alſo make fillagree moſtly of ſilver, which looks elegant, but wants likewiſe the extraordinary delicacy of the Malay work. The price of the workmanſhip depends upon the difficulty or uncommonneſs of the pattern. In ſome articles of uſual demand, it does not exceed one-third of the value of the gold; but in matters of fancy, it is generally equal to it.

FILLET, or FILET, in *Architecture*, denotes a little ſquare member or ornament uſed in divers places, and on divers occaſions, but generally as a ſort of corona over a greater moulding.

The fillet is the ſame with what the French call *reglet*, *bande*, and *bandelette*; the Italians *liſta* or *liſtella*.

FILLET, in *Heraldry*, a kind of orle or bordure, containing only a third or fourth part of the breadth of the common bordure. It is ſuppoſed to be withdrawn inwards, and is of a different colour from the field. It runs quite round, near the edge, as a lace over a cloak.

FILLET is alſo uſed for an ordinary drawn like the bar from the ſiniſter point of the chief acroſs the ſhield, in manner of a ſcarf; though it is ſometimes alſo ſeen in the ſituation of a bend, feſſe, croſs, &c.

According to Guillim, the fillet is a fourth part of the chief, and is placed in the chief point of the eſcutcheon.

FILLET is alſo uſed among painters, gilders, &c. for a little rule or reglet of leaf gold, drawn over certain mouldings; or on the edges of frames, pannels, &c. eſpecially when painted white, by way of enrichment.

Fi'y || Fuller.

FILLETS, in the *Manege*, are the loins of a horſe, which begin at the place where the hinder part of the ſaddle reſts.

FILLY, a term among horſe-dealers, to denote the female or male colt.

FILM, a thin ſkin or pellicle. In plants, it is uſed for that thin, woody ſkin, which ſeparates the ſeeds in the pods, and keeps them apart.

FILTER, or FILTRE, in *Chemiſtry*, &c. a piece of woollen cloth, linen, paper, or other matter, ſome of which are in the form of hollow inverted cones, uſed to filtrate or ſtrain liquors through. The filtre has the ſame uſe and effect with regard to liquids that the ſieve or ſearce has in dry matters.

Filters are of two ſorts. The firſt are ſimple pieces of paper or cloth, through which the liquor is paſſed without farther trouble. The ſecond are twiſted up like a ſkain or wick, and firſt wetted, then ſqueezed, and one end put in the veſſel that contains the liquor to be filtrated: the other end is to be out, and hang down below the ſurface of the liquor; by means hereof the pureſt part of the liquor diſtills drop by drop out of the veſſel, leaving the coarſer part behind. This filter acts as a ſyphon.

Water is freed from various impurities by means of baſins made of porous ſtones, which veſſels muſt be peculiarly beneficial in long voyages, and even upon land they are of conſiderable benefit, when none but ſtagnant waters are to be found, or ſprings iſſuing through clay.

A patent was granted in 1790 to a female potter, for inventing a compoſition to make filtering baſins, as a ſuccedaneum for that porous ſtone which is not every where to be found. She took four out of nine equal parts of tobacco-pipe clay, and five out of nine equal parts of ſea, river, or pit ſand, which ſhe uſed for making ſmall baſins ſufficient to contain one gallon of water. Her next proportions were equal parts of ſea, river, or pit ſand, and tobacco-pipe clay; her third proportions were three out of nine equal parts of tobacco-pipe clay; one out of nine equal parts of Stourbridge clay, or one out of nine equal parts of Windſor or other loam: and her fourth proportions were four out of eight equal parts of the burnt ground clay of which crucibles are made.

A patent was alſo granted to Mr Joſhua Collier of Southwark, for a moſt ingenious method of filtering and ſweetening water, oil, and every other liquid. The following is the contrivance, which combines the application of machinery with the antiſeptic properties of charcoal.

Fiſh oil is one of the liquids which he had particularly in view, to free it from every thing diſagreeable, either in taſte, ſmell, or colour, to accompliſh which he poured a quantity of oil into a convenient veſſel, heated to the temperature of 120° of Fahrenheit's thermometer, adding cauſtic mineral alkali of the ſpecific gravity of 1.25. He then agitated the mixture, afterwards allowing it to ſtand till the ſediment ſubſided; and then drew it off into another veſſel, with a ſufficient quantity of burnt charcoal finely powdered, and a ſmall quantity of diluted ſulphuric acid, to decompoſe the ſaponaceous matter ſtill ſuſpended in the oil, when the oil became

Filter. came clear at the ſurface. He then agitated the contents of this veſſel, and left the coaly, ſaline, and aqueous particles to ſubſide; afterwards paſſing it through proper ſtrainers, when it became quite tranſparent and fit for uſe.

The principle of the improved filtering machines conſiſts in combining hydroſtatic preſſure with the mode of filtering *per aſcenſum*, which procures the peculiar advantage of cauſing the fluid and its ſediment take oppoſite directions. The filtering ſurface remains the ſame, while the dimenſions of the chamber in which the ſediment is received may be varied. To adapt the machines to every purpoſe for which they are intended, chambers muſt be provided of various capacities, for the precipitated matter. The ſpace required is very great with reſpect to the oil trade, and as all dimenſions will be required occaſionally, no particular limits can be fixed. For diſtilleries and breweries they may be ſmaller in proportion, and a very ſmall chamber will be ſufficient for domeſtic economy. If water is to be freed from noxious particles, it muſt be made to paſs through an iron box in its way to the filtering chamber, and the box muſt contain charcoal finely powdered. The water is received into this box and delivered by two apertures, which are opened and cloſed by cocks.

Another part of the invention conſiſts in filtering machines in the form of ſtills, in which charcoal may be repeatedly burnt after any fluid ſubſtances have paſſed through it, for the purpoſe of freeing them from noxious particles, or diſcharging their colouring matter.

To the filtering apparatus of Mr Collier, inſtruments are attached for diſcovering the comparative qualities of oils, which depend in ſome meaſure on their ſpecific gravities; ſpermaceti oil, when compared with fiſh oils being as 875 to 920. To do this, a glaſs veſſel of any ſhape moſt convenient is employed, with a glaſs bubble, and a thermometer. If the oil is pure, the bubble ſinks, when the mercury riſes to a particular ſtandard. When ſpermaceti oil is impure, the bubble floats, though of the temperature required.

To determine the tendency of oils uſed for burning to congeal in cold weather, a freezing mixture may be put into a phial of thin glaſs, into which let a thermometer be immerſed, and a ſingle drop of the oil permitted to fall on the outſide of the veſſel, where it will inſtantly congeal. As the cold produced by the mixture decreaſes, let the temperature be obſerved by the thermometer at which the oil becomes fluid, and runs down the ſide of the glaſs.

The following is a ſhort deſcription of the apparatus contrived for this purpoſe. A (fig. 1. Plate CCXVII.) is the ciſtern, into which the water or other liquor to be filtered is put. B B, is a tube opening into the bottom of the ciſtern A, and bent along the bottom of the machine conveying the fluid into C C C the filtering chamber, which is covered with leather bound down round its circular rim, and through which leather the water is percolated. D D, The baſon riſing above the level of the chamber and receiving the filtered liquor. E, The ſpout by which it runs off into a pitcher or other veſſel. F, Another ſpout furniſhed with a cock to draw off the foul water from the chamber when neceſſary. G G G, The air tube, which begins above the level of the chamber, is covered with a button, which ſaves the leather from being cut, and has a ſmall lateral aperture for the air to be carried off. This pipe paſſes along the bottom and up the ſide, and riſing above the level of the water in the ciſtern, is there cloſed, except a ſmall lateral aperture through which the air eſcapes. H, A guard or rim with croſs bars put over the leather to keep it from being forced up by the water. It is faſtened down by means of two notches on oppoſite ſides of the ground, by which it locks into two ſtaples rivetted into the bottom of the baſon. I, The lid ſliding down to cover the water from duſt, and ſuſpended at pleaſure by means of K K, two ſprings on each tube for that purpoſe. L M N O, A cylindrical box containing charcoal, which is connected with the above by means of the tube P, and a continuation of the tube B. L M, The water tube B continued below the charcoal apparatus, ſo that the fluid may paſs through the ſame into the cylinder, from whence it enters the chambers at P, ſo as to be filtered through the leather as before deſcribed. R R, Collars which may be unſcrewed at pleaſure, ſo as to detach the charcoal apparatus whenever the charcoal requires to be purified by heat. SS, Two cocks to direct the fluid through the charcoal cylinder or immediately into the filtering chamber. Filter.

Fig. 2. A, A tub or ciſtern containing the oil to be filtered, and ſupplying a tube of ſufficient height for the hydroſtatic preſſure to operate. B B, A main tube of wood, tin, leather, or cloth, to which any number of bags, C C, of the ſize and ſhape of corn ſacks, or any convenient ſize or ſhape, may be connected. Theſe are bound to D D D, ſtraight double iron bars, furniſhed with a hinge at one end and a ſcrew at the other, by opening which the bags may be emptied. F, A trough underneath, made to receive the filtered oil from the receivers E E E.

Fig. 3. A, A funnel, caſk or ciſtern, into which the fluid is put which paſſes down. B, A tube fitted into the ſame, through which it enters. C, An iron ſtill, or ſtill of any other ſubſtance capable of ſuſtaining heat, full of finely powdered and ſifted charcoal, through the head of which the fluid paſſes into any receiver. D, A fire-place of any conſtruction to drive over the fluid remaining interſperſed among the charcoal, and alſo to purify the charcoal by an increaſe of temperature when required. E, A cock to let water into the flues to cool the apparatus for a ſubſequent operation.

Fig. 4. The trial glaſs with its thermometer.

FILTER is alſo a charm, ſuppoſed to have a virtue of inſpiring love. The word is derived from φιλτρον, which ſignifies the ſame thing, of φιλεω, *amo*, "I love."

The Greeks, when their love was without ſucceſs, had ſeveral arts to procure the affections of their beloved. The Theſſalian women were famous for their ſkill in this as well as other magical practices. The means whereby it was effected were of divers ſorts; it was ſometimes done by potions called φιλτρα, which are frequently mentioned in authors of both languages. Juvenal ſpeak thus:

> *Hic magicus affert cantus, hic Theſſala vendit*
> Philtra, *quibus valeant mentem vexare mariti.*

Their operations were violent and dangerous, and commonly deprived ſuch as drank them of their reaſon. Plutarch

Fig. 1.

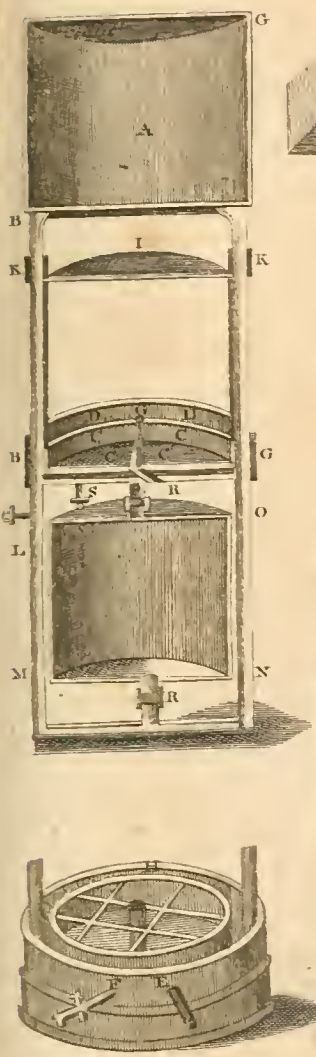


Fig. 2.

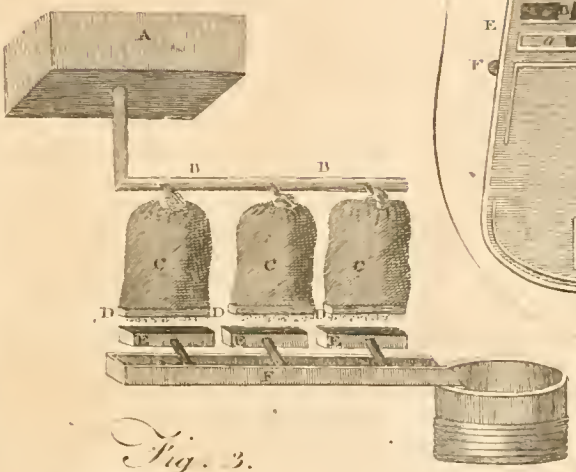
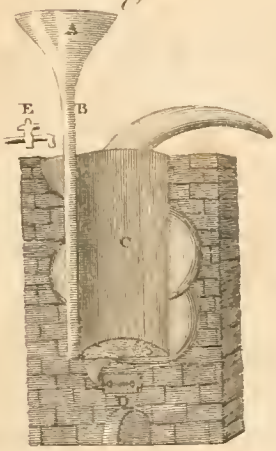


Fig. 3.



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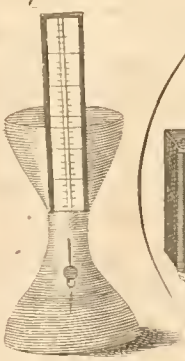

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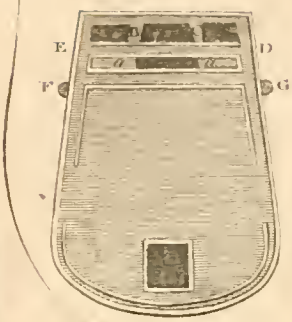

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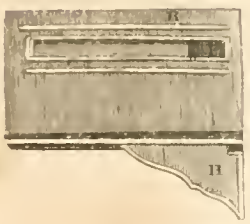

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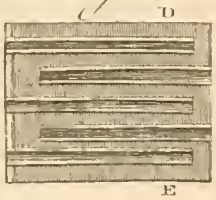

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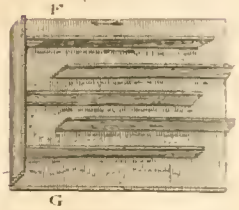
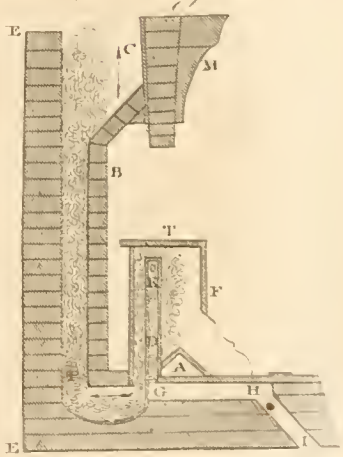
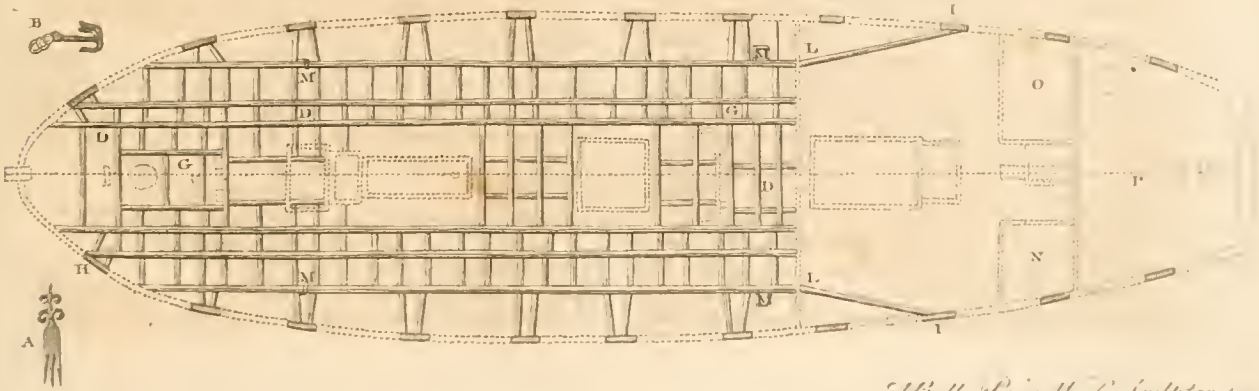


Fig. 5.

Fig. 6.



FIRE SHIP.



Albell Prin. Mal. Sculptor.

Filtration || Finch

Plutarch and Cornelius Nepos report, that Lucullus the Roman general firſt loſt his reaſon, and afterwards his life, by one of them. Lucretius the poet ended his life by the ſame way; and Caius Caligula, as Suetonius reports, was driven into a fit of madneſs by a filter given him by his wife Cæſonia, which ſtory is mentioned by the ſame poet. Ovid likewiſe aſſures us, that this was the uſual effect of ſuch potions.

The ingredients they were made of were of various ſorts; ſeveral of which applied by themſelves were thought effectual.

FILTRATION, the act of paſſing any liquor though a filtre, called alſo *colature*, *percolation*, and *tranſcolation*. See FILTRE.

FIMBRIÆ, *Fringes*. The extremities or borders of the tubæ Fallopianæ were formerly ſo called; the word ſignifying a *fringed border*, which that part reſembles.

FIMBRIATED, in *Heraldry*, an ordinary with a narrow border or hem of another tincture.

FIN, in *Natural Hiſtory*, a well known part of fiſhes, conſiſting of a membrane ſupported by rays, or little bony or cartilaginous oſſicles.

The office of the fins has commonly been ſuppoſed to be analogous to that of feathers in fowls; and to aſſiſt the fiſh in its progreſſive motion, or ſwimming; but the later naturaliſts find this a miſtake.

The tail is the great inſtrument of ſwimming: the fins only ſerve to keep the fiſh upright, and prevent vacillation or wavering. See ICHTHYOLOGY *Index*.

FINAL, in general, whatever terminates or concludes a thing; as *final* judgment, *final* ſentence, &c.

FINAL Cauſe, is the end for which the thing is done. The final cauſe is the firſt thing in the intention of a perſon who does a thing; and the laſt in the execution. See CAUSE.

FINAL Letters, among the Hebrew grammarians, five letters ſo called, becauſe they have a different figure at the end of words from what they have in any other ſituation.

FINAL, in *Geography*, a port town of Italy, ſubject to Genoa, and ſituated on the Mediterranean, about 37 miles ſouth-weſt of that city. It was ſold to the Genoeſe in 1713, by the emperor Charles VI.—E. Long. 9. 12. N. Lat. 44. 30.

FINANCES, in political economy, denote the revenues of a king or ſtate: analogous to the treaſury or exchequer of the Engliſh, and the fiſcus of the Romans. The word is derived from the German *finantz*, "ſcraping, uſury." Though Du Cange chooſes rather to deduce it from the barbarous Latin *financia preſtatio pecuniaria*.

Council of the FINANCES, under the former French government, correſponds to our lords commiſſioners of the treaſury: the comptroller general of the *finances*, to our lord high treaſurer, &c.

The French had a peculiar kind of figures, or numeral characters, which they call *chiffre de finance*.

FINCH-KIND, in *Ornithology*, a genus of birds known by the name of FRINGILLA. See FRINGILLA, ORNITHOLOGY *Index*.

FINCH, *Heneage*, earl of Nottingham, the ſon of Sir Heneage Finch, ſome time recorder of London, and of a younger branch of the Winchelſea family, was born in 1621. By his good parts and diligence, he became a noted proficient in the municipal laws: was made ſolicitor general by Charles II. on his reſtoration, and was very active in the proſecution of the regicides. In 1670 he was appointed attorney general; about three years after, lord keeper of the great ſeal, on the removal of the earl of Shafteſbury; and lord chancellor in 1675. He was created earl of Nottingham in 1681; and died in the year following, being quite worn out by the fatigues of buſineſs. He publiſhed ſeveral ſpeeches on the trials of the judges of King Charles I. with ſome few other things; and left behind him Chancery Reports in MS. Fine. *Blackſt. Comment.*

FINE, that which is pure and without mixture. The term is particularly uſed in ſpeaking of gold or ſilver.

FINE, in *Law*, hath divers applications. Sometimes it is uſed for a formal conveyance of lands or tenements, or of any thing inheritable, being *in eſſe temporis finis*, in order to cut off all controverſies. Others define it to be a final agreement between perſons, concerning any lands or rents, &c. of which any ſuit or writ is depending between them in any court.

FINE, ſometimes ſignifies a ſum of money paid for entering lands or tenements let by leaſe; and ſometimes a pecuniary mulct for an offence committed againſt the king and his laws, or againſt the lord of the manor.

FINES for Alienation, in *Feodal Law*. One of the attendants or conſequences of tenure by vaſſallhip. *KNIGHT-Service*, was that of fines due to the lord for every alienation, whenever the tenant had occaſion to make over his land to another. This depended on the nature of the feodal connexion; it not being reaſonable, nor allowed, that a feudatory ſhould transfer his lord's gift to another, and ſubſtitute a new tenant to do the ſervice in his own ſtead, without the conſent of the lord: and, as the feodal obligation was conſidered as reciprocal, the lord alſo could not alienate his ſeignory without the conſent of his tenant, which conſent of his was called an *attornment*. The reſtraint upon the lord ſoon wore away; that upon the tenant continued longer. For, when every thing came in proceſs of time to be bought and ſold, the lords would not grant a licenſe to their tenants to aliene, without a fine being paid; apprehending that, if it was reaſonable for the heir to pay a fine or relief on the renovation of his paternal eſtate, it was much more reaſonable that a ſtranger ſhould make the ſame acknowledgment on his admiſſion to a newly purchaſed feud. In England, theſe fines ſeem only to have been exacted from the king's tenants *in capite*, who were never able to aliene without a licenſe: but as to common perſons, they were at liberty, by *magna charta*, and the ſtatute of *quia emptores* (if not earlier), to aliene the whole of their eſtate, to be holden of the ſame lord as they themſelves held it of before. But the king's tenants *in capite*, not being included under the general words of theſe ſtatutes, could not aliene without a licenſe: for if they did, it was in ancient ſtrictneſs an abſolute forfeiture of the land; though ſome have imagined otherwiſe. But this ſeverity was mitigated by the ſtatute 1 Edw. III. c. 12. which ordained, that in ſuch caſe the lands ſhould not be forfeited, but a reaſonable fine be paid to the king. Upon which ſtatute it was ſettled, that one-third of the yearly value ſhould be

paid

Finers
||
Fingal.

paid for a licenſe of alienation; but, if the tenant preſumed to aliene without a licenſe, a full year's value ſhould be paid. Theſe fines were at laſt totally taken away by ſtatute 12 Car. II. c. 24. See KNIGHT-*Service*.

FINE-Drawing, or *Rentering*, a dexterous ſewing-up or rejoining the parts of any cloth, ſtuff, or the like, torn or rent in the dreſſing, wearing, &c.

It is prohibited to *fine-draw* pieces of foreign manufacture upon theſe of our own, as has formerly been practiſed. See RENTERING.

FINE-Stiller, in the diſtillery. That branch of the art which is employed on the diſtilling the ſpirit from treacle or other preparations or recrements of ſugar, is called *fine-ſtilling*, by way of diſtinction from malt-ſtilling; and the perſon who exerciſes this part of the trade is called a *fine-ſtiller*.

The operation in procuring the ſpirit from ſugar is the ſame with that uſed in making the malt ſpirit; a waſh of the ſaccharine matter being made with water from treacle, &c. and fermented with yeaſt. It is uſual to add in this caſe, however, a conſiderable portion of malt, and ſometimes powdered jalap, to the fermenting backs. The malt accelerates the fermentation, and makes the ſpirit come out the cheaper, and the jalap prevents the riſe of any muſty head on the ſurface of the fermenting liquor, ſo as to leave a greater opportunity for the free acceſs of the air, and thus to ſhorten the work, by turning the foamy into a hiſſing fermentation.

FINERS *of* GOLD *and* SILVER, are thoſe who purify and part thoſe metals from other coarſer ones by fire and acids. They are alſo called *parters* in our old law books, and ſometimes *departers*.

FINERY, in the iron works, is one of the two forges at which they hammer the ſow or pig iron.

Into the finery they firſt put the pigs of iron, placing three or four of them together behind the fire, with a little of one end thruſt into it; where, ſoftening by degrees, they ſtir and work them with long bars of iron, and expoſe at different times different parts to the blaſt of the bellows, in order to refine it as equally as poſſible, till the metal runs together with a round maſs or lump, which they call a *half bloom*. They then take this out, and give it a few ſtrokes with their ſledges; afterwards they carry it to a great heavy hammer, raiſed by the motion of a water wheel; where, applying it dexterouſly to the blows, they preſently beat it out into a thick ſhort ſquare. This they put into the finery again, and heating it red hot, they work it under the ſame hammer till it comes to be in the ſhape of a bar in the middle, but with two ſquare knobs at the ends, which they call an *ancony*. It is then carried into the other forge called the *chaffry*.

FINEERING. See VENEERING.

FINESSE, a French term, of late current in Engliſh. Literally, it is of no farther import than our Engliſh *fineneſs*; but among us it is chiefly uſed to denote that peculiar delicacy or ſubtility perceived in works of the mind, and the niceſt and moſt ſecret and ſublime parts of any ſcience or art.

It is ſometimes uſed to expreſs that kind of ſubtility made uſe of for the purpoſes of deception.

FINGAL, king of Morven, in ancient Caledonia. He flouriſhed in the third century: and according to the Iriſh hiſtories died in the year 283, although there is ſome reaſon from Oſſian's poems for placing his death a few years later. Fingal was deſcended in all probability from thoſe Celtic tribes who were the firſt inhabitants of Britain. Tradition, and the poems of Oſſian, give him a long line of royal anceſtors, ſuch as Combal, Trenmor, Trathal, &c. who had all reigned over the ſame territory. Whether this territory was bounded by the Caledonian foreſt, or extended ſomewhat farther to the ſouth, towards the Roman province, is uncertain; but there is no doubt of its having extended over all the north and weſt Highlands, comprehending the Hebrides, whoſe petty chiefs were all ſubject to the king of Morven. His principal place of reſidence was Selma, which was probably in the neighbourhood of Glenco, ſuppoſed to be the Cona of Oſſian; though ſome imagine it to have been in Strath-Conan in Moray. The truth ſeems to be, that as Fingal and his people lived by hunting, they often ſhifted their habitations. Hence, in all parts of the Highlands we find, in the names of places, buildings, &c. ſuch monuments as juſtify their ſeveral claims for the honour of Fingal's reſidence. Fingal acquired great fame by his proweſs in arms. He made many ſucceſsful incurſions into the Roman province, from whence he carried away thoſe ſpoils which his ſon ſo often mentions under the names of the *wine of the ſtranger*, and the *wax of the ſtranger*. By ſea we find him frequently making voyages to Scandinavia, the Orkneys, and Ireland; called by Oſſian *Lochlin*, *Inniſtore* and *Ullin*. Several of theſe expeditions were celebrated by his ſon in epic poems, of which two only remain, Fingal and Temora. In the laſt of theſe poems, we find Fingal fighting together with his grandſon Oſcar. How long he lived afterwards is uncertain. He is ſaid to have died a natural death; and therefore none of his ſon's poems relate to this event, though it is occaſionally mentioned in many of them. "Did thy beauty laſt, O Ryno? Stood the ſtrength of car-borne Oſcar? Fingal himſelf paſſed away; and the halls of his fathers have forgot his ſteps. The blaſt of the north opens thy gates, O king, and I behold thee ſitting on miſt, dimly gleaming in all thine arms. Thy form now is not the terror of the valiant: but like a watery cloud, when we ſee the ſtars behind it, with their weeping eyes. Thy ſhield is like the aged moon; thy ſword vapour half kindled with fire. Dim and feeble is the chief who travelled in brightneſs before. But thy ſteps are on the winds of the deſert, and the ſtorms darken in thy hand. Thou takeſt the ſun in thy wrath, and hideſt him in thy clouds. The ſons of little men are afraid, and a thouſand ſhowers deſcend.—*Berrathon*.

Fingal.

"The character of Fingal (Dr Blair obſerves) is is perhaps the moſt perfect that ever was drawn by a poet, for we may boldly defy all the writers of antiquity to ſhow us any hero equal to Fingal. Throughout the whole of Oſſian's works, he is preſented to us in all that variety of lights which give the full diſplay of a character. In him concur almoſt all the qualities that can ennoble human nature; that can either make us admire the hero, or love the man. He is not only unconquerable in war, but he makes his people happy by his wiſdom in the days of peace. He is truly the father of his people. He is known by the epithet of

'Fingal

Fingal. ‘ Fingal of the mildeſt look,’ and diſtinguiſhed on every occaſion by humanity and generoſity. He is merciful to his foes, full of affection to his children, full of concern about his friends, and never mentions Agandecca, his firſt love, without the utmoſt tenderneſs. He is the univerſal protector of the diſtreſſed; none ever went ſad from Fingal.—‘ O Oſcar! bend the ſtrong in arms, but ſpare the feeble hand. Be thou a ſtream of many tides againſt the foes of thy people; but like the gale that moves the graſs to thoſe who aſk thine aid: ſo Trenmor lived; ſuch Trathal was; and ſuch has Fingal been. My arm was the ſupport of the injured; the weak reſted behind the lightning of my ſteel.’ Theſe were the maxims of true heroiſm, to which he formed his grandſon. His fame is repreſented as everywhere ſpread; the greateſt heroes acknowledge his ſuperiority; his enemies tremble at his name; and the higheſt encomiums that can be beſtowed on one whom the poet would moſt exalt, is to ſay, That his ſoul was like the ſoul of Fingal. Wherever he appears, we behold the hero. The objects he purſues are always great; to bend the proud, to protect the injured, to defend his friends, to overcome his enemies by generoſity more than by force. Some ſtrokes of human imperfection and frailty are what uſually give us the moſt clear view and the moſt ſenſible impreſſion of a character, becauſe they preſent to us a man ſuch as we have ſeen; they recal known features of human nature. When poets go beyond this range, and attempt to deſcribe a faultleſs hero, they, for the moſt part, ſet before us a ſort of vague undiſtinguiſhable character, ſuch as the imagination cannot lay hold of, or realize to itſelf as the object of affection. But Fingal, though exhibited without any of the common human failings, is nevertheleſs a real man; a character which touches and intereſts every reader.”

We may obſerve, that Fingal appears to have been no leſs a poet than a warrior; at leaſt, in all thoſe paſſages aſcribed to him in the poems of his ſon, there is a grandeur and loftineſs that elevates them above the common ſtyle even of Oſſian. The following paſſage from the poem of *Carthon* may be taken as a ſpecimen of Fingal's poetry. “—‘ Raiſe, ye bards,’ ſaid the mighty Fingal, ‘ the praiſe of the unhappy Moina. Call her ghoſt, with your ſongs, to our hills; that ſhe may reſt with the fair of Morven, the ſunbeams of other days, and the delight of heroes of old.—I have ſeen the walls of Balclutha, but they were deſolate. The fire had reſounded in the halls; and the voice of the people is heard no more. The ſtream of Clutha was removed from its place by the fall of the walls. The thiſtle ſhook, there, its lonely head: the moſs whiſtled to the wind. The fox looked out from the windows; the rank graſs of the wall waved round his head. Deſolate is the dwelling of Moina: ſilence is in the houſe of her fathers. Raiſe the ſong of mourning, O bards, over the land of ſtrangers. They have but fallen before us; for, one day we muſt fall.—Why doſt thou build the hall, ſon of the winged days? Thou looketſt from thy towers to-day; yet a few years, and the blaſt of the deſert comes; it howls in thy empty court, and whiſtles round thy half-worn ſhield.—And let the blaſt of the deſert come! We ſhall be renowned in our day. The mark of my arm ſhall be in the battle, and my name in the ſong of bards. Raiſe the ſong; ſend round the ſhell: and let joy be heard in my hall. When thou, ſun of heaven, ſhalt fail! if thou ſhalt fail, thou mighty light! if thy brightneſs is for a ſeaſon, like Fingal; our fame ſhall ſurvive thy beams.’—Such was the joy of Fingal in the day of his joy. His thouſand bards leaned forward from their ſeats, to hear the voice of the king. It was like the muſic of the harp on the gale of the ſpring. Lovely were thy thoughts, O Fingal! Why had not Oſſian the ſtrength of thy ſoul? But thou ſtandeſt alone, my father; and who can equal the king of Morven?” See Ossian.

Fingers || Fire.

FINGERS, in *Anatomy*, the extreme part of the hand divided into five members. See Anatomy, N° 56.

FINING *of* Liquors. See Clarification.

FINISTERRE, the moſt weſterly cape or promontory of Spain, in 10. 15. W. Long. and 43° N. Lat. This cape is likewiſe the moſt weſterly part of the continent of Europe.

FINITE, ſomething bounded or limited, in contradiſtinction to infinite.

FINLAND (the duchy of), is bounded on the weſt by the gulf of Bothnia, on the eaſt by Muſcovy, on the ſouth by the gulf of Finland and Ingria, and on the north by Bothnia and Lapland. It is about 200 miles in length, and almoſt as much in breadth. It contains many lakes; on which are ſeveral iſlands, which are generally rocks or inacceſſible mountains The inhabitants are ſmall of ſtature, capable of enduring hardſhips, and good ſoldiers. The Ruſſians have for ſome time rendered themſelves maſters of a good part of this province; the reſt belongs to Sweden. It is divided into ſeven provinces; 1. Finland; 2. Cajana; 3. Thavaſthia; 4. Nyeland; 5. Savolaxia; 6. Carelia; and, 7. Kexholmia.

Finland Proper is an agreeable country, and lies over-againſt the city of Stockholm, near the place where the gulfs of Bothnia and Finland meet. It is divided into South and North Finland. It is diverſified with mountains, foreſts, lakes, meadows, and pleaſant fields. The inhabitants ſalt the fiſh they do not conſume themſelves, and ſend it into foreign countries.

FINNINGIA, or Fenninia, in *Ancient Geography*, the true reading for *Eningia* in Pliny, which he makes an iſland, but is more truly a peninſula. Now Finland, a province of Sweden. *Fenni*, or *Finni*, the people; whoſe ferocity was extraordinary, poverty extreme, herbs their food, ſkins their covering, and the ground their couch: regardleſs of man and of gods, they attained to a very difficult thing, not to have a ſingle wiſh to form, (Tacitus.)

FIR-TREE. See Pinus, Botany *Index*.

FIRE, in *Phyſiology*, ſignifies that ſubtile inviſible ſubſtance by which bodies are expanded or enlarged in bulk, and become hot to the touch; fluids are rarefied into vapour; ſolid bodies become fluid, and in like manner are at laſt diſſipated, or, if incapable of being carried off in vapour, are at length melted into glaſs. It ſeems likewiſe to be the chief agent in nature on which animal and vegetable life have an immediate dependence, and without which it does not appear that nature itſelf could ſubſiſt a ſingle moment.

The diſputes concerning fire, which for a long time divided

Fire. divided philoſophers, have now in a great meaſure, though not wholly, ſubſided. The celebrated philoſophers of the laſt century, Bacon, Boyle, and Newton, were of opinion, that fire was no diſtinct ſubſtance from other bodies, but that it conſiſted entirely in the violent motion of the parts of any body. As no motion, however, can be produced without a cauſe, they were obliged to have recourſe to a mechanical force or impulſe as the ultimate chuſe of fire in all caſes. Thus Boyle tells us, that when a piece of iron becomes hot by hammering, "there is *nothing* to make it ſo, except the forcible motion of the hammer impreſſing a vehement and variouſly determined agitation on the ſmall parts of the iron." Bacon defines *heat*, which he makes ſynonymous with fire, to be "an expanſive undulatory motion in the minute particles of a body, whereby they tend with ſome rapidity from a centre towards a circumference, and at the ſame time a little upwards." Sir Iſaac Newton ſaid nothing poſitive upon the ſubject; but conjectured that groſs bodies and light might be convertible into one another; and that great bodies of the ſize of our earth when violently heated, might continue and increaſe their heat by the mutual action and reaction of their parts.

But while the mechanical philoſophers thus endeavoured to account for the phenomena of fire upon the ſame principles which they judged ſufficient to explain thoſe of the univerſe in general, the chemiſts as ſtrenuouſly aſſerted that fire was a fluid of a certain kind, diſtinct from all others, and univerſally preſent throughout the whole globe. Boerhaave particularly maintained this doctrine; and in ſupport of it brought the following argument, that ſteel and flint would ſtrike fire, and produce the very ſame degree of heat, in Nova Zembla, which they would do under the equator. Other arguments were drawn from the increaſed weight of metalline calces, which they ſuppoſed to proceed from the fixing of the element of fire in the ſubſtance whoſe weight was thus increaſed. By theſe experiments Mr Boyle himſelf ſeems to have been ſtaggered; as he publiſhed a treatiſe on the poſſibility of making fire and flame ponderable; though this was directly contrary to his own principles already quoted. For a long time, however, the matter was moſt violently diſputed; and the mechanical philoſophers, though their arguments were equally inconcluſive with thoſe of their adverſaries, at laſt prevailed through the prejudice in favour of Sir Iſaac Newton, who indeed had ſcarce taken any active part in the conteſt.

That the cauſe of fire cannot be any mechanical motion which we can impreſs, is very evident; becauſe on mechanical principles an effect muſt always be proportionable to the cauſe. In the caſe of fire, however, the effect is beyond all calculation greater than the cauſe, ſuppoſing the latter to be only a mechanical perculſion, as in the caſe of hammering iron till it be red hot. By a few ſtrokes of a hammer, the particles of a piece of iron, we ſhall allow, may be ſet in a violent motion, and thus produce fire. If, however, we direct the motion of theſe particles upon another body whoſe parts are at reſt, and in ſome degree coherent, it is plain that the latter will reſiſt and diminiſh that motion of the particles already moved, in proportion to their *vis inertiæ*, as well as the coheſion of the parts of the ſecond body, if indeed we can ſuppoſe the *vis inertiæ* of matter to be different from the effect of gravitation, coheſion, or ſome other power acting upon it. By no argumentation whatever, then, can we ſhow upon mechanical principles, why fire ſhould have ſuch a tendency to increaſe and multiply itſelf without end, as we ſee it has, even abſtracting from all conſideration of the neceſſity of air for continuing the action of fire. Fire.

The action of the air in augmenting and continuing the power of fire, ſeems ſcarce at all to have been conſidered by thoſe who firſt undertook an inveſtigation of the ſubject. It evidently gave riſe to the Hutchinſonian hypotheſis, that fire, light, and air, were convertible into one another. This, however, is equally untenable with the mechanical hypotheſis; for later diſcoveries have ſhown, that our atmoſphere is compoſed of two diſtinct fluids, only one of which is fit for ſupporting flame; and if we ſhould ſuppoſe this to be the only proper air, it is in like manner demonſtrated, that this pure fluid is not homogeneous, but compoſed of a gravitating and non-gravitating ſubſtance; the latter of which only has the properties of fire; ſo that this element is ſtill as inviſible as ever; nor can it be ſhown by any experiment that *fire per ſe* has ever been changed into a palpable or gravitating ſubſtance.

The experiments which firſt ſeemed to bring this diſpute to a deciſion were thoſe of Dr Black, concerning what he called *latent heat*; on which ſome other names, ſuch as *abſolute heat*, *ſpecific fire*, &c. have been beſtowed, very little to the advancement of ſcience in general. From theſe diſcoveries it appears, that fire may exiſt in bodies in ſuch a manner as not to diſcover itſelf in any other way than by its action upon the minute parts of the body; but that ſuddenly this action may be changed in ſuch a manner as no longer to be directed upon the particles of the body itſelf, but upon external objects: in which caſe we then perceive its action by our ſenſe of feeling, or diſcover it by the thermometer, and call it *ſenſible heat*. This expreſſion, it muſt be owned, is improper; and the uſe of the word *heat*, inſtead of *fire*, has produced ſome confuſion, which it is not now eaſy to avoid in ſpeaking on theſe ſubjects. By the word *heat*, we ought always to underſtand the effect of fire, or the fluid acting in a certain manner, rather than the mere element itſelf, which, it is certain, from the experiments juſt mentioned, may exiſt in ſubſtances actually *cold* to the touch.

From this diſcovery made by Dr Black, along with many others in electricity, and recorded at length in various articles of this work, it is now almoſt univerſally allowed, that fire is a diſtinct fluid, capable of being transferred from one body another. But when this was diſcovered, another queſtion no leſs perplexing occurred, viz. what kind of a fluid it was; or whether it bears any analogy to thoſe with which we are better acquainted? Here we find two fluids, viz. the ſolar light, and the electric matter, both of which occaſionally act as fire, and which therefore ſeem likely to be all the ſame at bottom. By the vulgar, indeed, the matter has long ago been determined; and the rays of the ſun as well as the electrical fluid, have been promiſcuouſly denominated *elementary fire*. Philoſophers, indeed, have withheld their aſſent; though their

Fire. their reaſons for ſo doing are by no means apparent. The moſt ſtrange ſuppoſitions, however, have been made concerning the nature of both thoſe fluids; and on the moſt ſlender grounds imaginable, or rather, on no grounds at all, they have been ſuppoſed to be phlogiſton itſelf, or to contain a large proportion of it. Mr Scheele went ſo far in this way as to form an hypotheſis, which he endeavoured to ſupport by ſome experiments, that fire is compoſed of dephlogiſticated air and phlogiſton. But it is now aſcertained beyond all poſſibility of diſpute that the reſult of ſuch a combination is not fire, but fixed air; ſo that we need not take any farther notice of this hypotheſis than juſt to obſerve, that it would have been altogether untenable, even though this diſcovery had not been made; becauſe the dephlogiſticated air itſelf is not a ſimple but a compound ſubſtance, as has already been obſerved; and that in all caſes of combuſtion the one part of the air is ſeparated from the other.

It was long ago obſerved by Sir Iſaac Newton, that heat was certainly conveyed by a medium more ſubtile than the common air; becauſe two thermometers, one included in the vacuum of an air pump, the other placed in the open air, at an equal diſtance from the fire, would grow equally hot in near the ſame time. The conſequence of this, had he purſued the thought, was, that fire itſelf was equally preſent in all places, and as active where there was no terreſtrial matter as where there was. New improvements in the air pump have enabled ſucceeding philoſophers to make more perfect vacuums, ſuch as it has been ſuppoſed even the electric matter cannot paſs through. It is not to be doubted, however, that, even there, the thermometer would be heated by a fire as well as in the open air. Fire, therefore, exiſts and acts where there is no other matter, and of conſequence is a fluid *per ſe*, independent of every terreſtrial ſubſtance, without being generated or compounded of any thing we are yet acquainted with. To determine the nature of the fluid, we have only to conſider whether any other can be diſcovered which will paſs through the perfect vacuum juſt mentioned, and act there as fire. Such a fluid we find in the ſolar light, which is well known to act even *in vacuo* as the moſt violent fire. The ſolar light will likewiſe act in the very ſame manner in the moſt intenſe cold; for M. de Sauſſure has found, that on the cold mountain top the ſunbeams are equally, nay more powerful, than on the plain below. It appears, therefore, that the ſolar light will produce heat independent of any other ſubſtance whatever; that is, where no other body is preſent, at leaſt as far as we can judge, except the light itſelf and the body to be acted upon. We cannot therefore avoid concluding, that a certain modification of the light of the ſun is the cauſe which produces heat, expanſion, vapour, &c. and anſwers to the reſt of the characters given in our definition of fire, and that independent of any other ſubſtance whatever.

For a further diſcuſſion of this ſubject, ſee CHEMISTRY and ELECTRICITY *Index*.

Wild FIRE, a kind of artificial or factitious fire, which burns even under water, and that with greater violence than out of it.

It is compoſed of ſulphur, naphtha, pitch, gum, and bitumen; and is only extinguiſhable by vinegar mixed with ſand and urine, or by raw hides.

Its motion or tendency is ſaid to be contrary to that of natural fire, and always follows the direction in which it is thrown; whether it be downwards, ſidewiſe, or otherwiſe. The French call it *Greek fire*, or *feu Gregeois*, becauſe firſt uſed by the Greeks, about the year 660: as is obſerved by the Jeſuit Petavius, on the authority of Nicetas, Theophanes, Cedrenus, &c. Fire.

The inventor, according to the ſame Jeſuit, was an engineer of Heliopolis, in Syria, named *Callinicus*, who firſt applied it in the ſea-fight commanded by Conſtantine Pogonates againſt the Saracens, near Cyzicus, in the Helleſpont; and with ſuch effect, that he burnt the whole fleet therewith wherein were 30,000 men. But others will have it of a much older date, and hold Marcus Gracchus the inventor: which opinion is ſupported by ſeveral paſſages both in the Greek and Roman writers, which ſhows it to have been anciently uſed by both theſe nations in their wars.

Conſtantine's ſucceſſors uſed it on divers occaſions with equal advantage as himſelf: and what is remarkable enough is, that they were ſo happy as to keep the ſecret of the compoſition to themſelves, ſo that no other nation knew it in the year 960.

Hugh king of Burgundy, demanding ſhips of the emperor Leo, for the ſiege of Freſne, deſired likewiſe the Greek fire.

F. Daniel gives a good deſcription of the Greek fire, in his account of the ſiege of Damietta under St Louis. Every body, ſays that author, was aſtoniſhed with the Greek fire, which the Turks then prepared; and the ſecret whereof is now loſt. They threw it out of a kind of mortar; and ſometimes ſhot it with an odd ſort of croſs-bow, which was ſtrongly bent by means of a handle or winch, of much greater force than the mere arm. That thrown with the mortar ſometimes appeared in the air of the ſize of a tun, with a long tail, and a noiſe like that of thunder. The French by degrees got the ſecret of extinguiſhing it, in which they ſucceeded ſeveral times.

Machine for preſerving from FIRE. This machine conſiſts of a pole, a rope, and a baſket. The pole is of fir, or a common ſcaffold pole, of any convenient length from 36 to 46 feet; the diameter at bottom, or greateſt end, about five inches; and at the top, or ſmalleſt end, about three inches. At three feet from the top is a mortiſe through the pole, and a pulley fixed to it of nearly the ſame diameter with the pole in that part. The rope is about three quarters of an inch diameter, and twice the length of the pole, with a ſpring hook at one end, to paſs through the ring in the handle of the baſket when uſed: it is put through the mortiſe over the pulley, and then drawn tight on each ſide to near the bottom of the pole, and made faſt there till wanted. The baſket ſhould be of ſtrong wicker-work, three feet and a half long, two feet and a half wide, rounded off at the corners, and four feet deep, rounding every way at the bottom. To the top of the baſket is fixed a ſtrong iron curve or handle, with an eye or ring in the middle; and to one ſide of the baſket, near the top, is fixed a ſmall cord or guide-rope of about the length of the pole. When the pole is raiſed, and ſet againſt a houſe over the window from which any perſons are to eſcape, the manner of uſing it is ſo plain and obvious, that it needs not be deſcribed. The moſt convenient diſtance from the houſe for the foot *Ann Reg.* xviii. 117.

Fire. of the pole to ſtand, where practicable, is about 12 or 14 feet. If two ſtrong iron ſtraps, about three feet long, rivetted to a bar acroſs and ſpreading about 14 inches at the foot, were fixed at the bottom of the pole, this would prevent its turning round or ſlipping on the pavement. And if a ſtrong iron hoop, or ferrule, rivetted (or welded) to a ſemicircular piece of iron ſpreading about 12 inches, and pointed at the ends, were fixed on at the top of the pole, it would prevent its ſliding againſt the wall.

When theſe two laſt mentioned irons are fixed on, they give the pole all the ſteadineſs of a ladder; and becauſe it is not eaſy, except to perſons who have been uſed to it, to raiſe and ſet upright a pole of 40 feet or more in length, it will be convenient to have two ſmall poles or ſpars of about two inches diameter, fixed to the ſides of the great pole at about two or three feet above the middle of it, by iron eyes rivetted to two plates ſo as to turn every way; the lower end of theſe ſpars to reach within a foot of the bottom of the great pole, and to have ferrules and ſhort ſpikes to prevent ſliding on the pavement, when uſed occaſionally to ſupport the great pole like a tripod. There ſhould be two ſtrong aſh trundles let through the pole, one at four feet and one at five feet from the bottom, to ſtand out about eight inches on each ſide, and to ſerve as handles, or to twiſt the rope round in lowering a very heavy weight. If a block and pulley were fixed at about the middle of the rope, above the other pulley, and the other part of the rope made to run double, it would diminiſh any weight in the baſket nearly one half, and be very uſeful in drawing any perſon up, to the aſſiſtance of thoſe in the chambers, or for removing any effects out of a chamber, which it might be dangerous to attempt by the ſtairs.

It has been proved, by repeated trials, that ſuch a pole as we have been ſpeaking of can be raiſed from the ground, and two or three perſons taken out of the upper windows of a houſe, and ſet down ſafely in the ſtreet, in the ſpace of 35 ſeconds, or a little more than half a minute. Sick and infirm perſons, women, children, and many others, who cannot make uſe of a ladder, may be ſafely and eaſily brought down from any of the windows of a houſe on fire by this machine, and, by putting a ſhort pole through the handles of the baſket, may be removed to any diſtance without being taken out of the baſket. The pole muſt always have the rope ready fixed to it, and may be conveniently laid up upon two or three iron hooks under any ſhade or gateway, and the baſket ſhould be kept at the watch-houſe. When the poll is laid up, the two ſpars ſhould always be turned towards the head of it. The baſket ſhould be made of peeled rods, and the pole and ſpars painted of a light ſtone colour, to render it more viſible when uſed in the night.

Machines for extinguiſhing FIRE. In the year 1734, the ſtate of Sweden offered a premium of 20,000 crowns for the beſt method of ſtopping the progreſs of accidental fires; when one Mr Fuches, a German phyſician, made a preparation for that end, and the experiment was made on a houſe built on purpoſe of dry fir, at Kegard iſland. In the building were placed ſeveral tubs of tar and pitch, and a great quantity of chips, all which were ſet on fire; flames iſſuing through the top of the houſe, windows, &c. when he threw in one of the barrels containing the preparation, which immediately quenched the flames; a ſecond barrel entirely cleared the ſmoke away; and the whole was executed to the ſatisfaction of the ſpectators, and to the no ſmall ſatisfaction of the inventor, who was about to return home, when unexpectedly the flames broke out again, ſuppoſed to be occaſioned by a ſmall quantity of combuſtible matter being introduced and ſet on fire ſecretly by ſome malicious perſon. Upon this the wrong-headed mob fell upon Mr Fuches, and beat him moſt unmercifully, ſo that he narrowly eſcaped with his life. He ſoon after left the country, and never could be prevailed on (though ſtrongly perſuaded by ſome of the moſt eminent citizens) to return. It is ſaid, another experiment of the ſame kind was tried in the year 1761 in Holland; but rendered abortive through the perverſeneſs of the populace. Fire.

Attempts of a ſimilar nature have met with a better reception in England. Of theſe the moſt ſucceſsful was that of Mr Godfrey, whoſe contrivance is thus deſcribed by Mr Ambroſe Godfrey, grandſon to the inventor. "The machine to be employed conſiſts of a ſmall portion of gunpowder cloſely confined; which, when animated by fire, acts by its elaſtic force upon a proper medium, and not only divideth it into the minuteſt atoms, but diſperſeth it alſo in every direction, ſo as immediately to extinguiſh any fire within a certain diſtance. This medium is a liquor ſtrongly impregnated with a preparation of antiphlogiſtic principles, which by their action upon burning materials extinguiſh the flames and reduce them in general to the ſtate of a black coal; and, by its oppoſite nature to fire, hinders the remaining ſparks, notwithſtanding the admiſſion of the air, from kindling the flames afreſh. By this means, the great point is obtained, in giving ſufficient time for totally extinguiſhing any remains of fire.

"They who preſume that water only will perform this will find themſelves greatly miſtaken, as the draught of air will certainly rekindle the neighbouring materials, which are very fit to receive a freſh flame, the fire not being extinguiſhed by the quantity of water, but rather by the expanſion and rarefaction of its particles. There are ſeveral ſizes of theſe machines, from five to fifty pounds weight, in a portable and rather ſmall compaſs, and may generally be carried to any place where a man can go himſelf.

"But though theſe machines will prevent great fires by a timely application, they will not extinguiſh them after they have reached a frightful height, and ſeveral houſes, perhaps near a whole ſtreet, are in flames. The floors muſt be ſtanding, and acceſs to the building ſafe, otherwiſe no perſon can be ſuppoſed to approach near enough to apply them in a proper manner. Every fire has its beginning for the moſt part in ſome apartment; and, as ſoon as diſcovered, the family, inſtead of loſing all preſence of mind, ſhould immediately apply one or more of theſe machines, which will then fully anſwer the intention. The proper time of applying them, ſuppoſes that they are ready at hand. It will be in vain to think of fetching them from any conſiderable diſtance, as it will then be too late for them to perform any important ſervice: except indeed being the probable means of ſaving ſome adjacent houſe, by extinguiſhing

Fire. tinguiſhing the flames as often as they break out, till the building firſt on fire is totally conſumed, and, by falling into ruins, leaves the other in perfect ſafety."

On the 19th of May 1761, at noon, Mr Godfrey's experiment for extinguiſhing fire, was tried in a houſe erected for that purpoſe, near Mary-le-bone. Their royal highneſſes, the duke of York, Prince William Henry, Prince Henry Frederick, a great number of perſons of rank and diſtinction, and many of the learned world, gave their attendance on this ſingular occaſion. The houſe, which was of brick, conſiſted of three rooms one above another, a ſtaircaſe, chimney, lath and plaſter ceilings, and a kind of wainſcotting round the rooms, of rough deal. Exactly at 12 o'clock the ground room, and that up one pair of ſtairs, were ſet on fire by lighting the faggots and ſhavings laid in there for that purpoſe: in about 15 minutes the wainſcot of the under room was thought to be ſufficiently in flames, and three of the machines were thrown in; which, by almoſt immediate and ſudden exploſions, inſtantaneouſly extinguiſhed the flames, and the very ſmoke in that apartment in a few minutes totally diſappeared. By this time, the firemen, &c. who had the care of throwing in the machines, gave an alarm that the ſtaircaſe had taken fire, and that it was neceſſary directly to go to work upon the next room; which was accordingly done, and with the ſame effect. The experiment, however, hitherto did not univerſally ſatisfy: in the laſt inſtance eſpecially it was thought to be too haſtily put in execution; and the populace without ſide the paling, who were ſuppoſed to amount to near 20,000, and whoſe curioſity, from the very nature of their ſituation, remained much diſſatisfied, began to grow rather riotous, and talked of a ſecond bottle conjuror. For the ſake of the experiment, therefore, and to remove all manner of doubt, Mr Godfrey conſented to a third experiment in the upper room, which was entirely of wood. The flames were now ſuffered to get to a conſiderable height, and even the window frames deſtroyed, before the machines were thrown in: which, however, anſwered exactly as the former had done; and, being quite in ſight of the out-ſtanders, met with univerſal approbation.

Theſe machines of Mr Godfrey's, it is evident, would be of great uſe in extinguiſhing fires on ſhipboard; and might be conſidered as a no leſs neceſſary part of a ſhip's lading, than her ſtores or ammunition.

The hint of theſe machines is ſaid to have been taken by Dr Godfrey from the invention of one Zachary Greyl, who exhibited machines ſimilar to thoſe of Dr Godfrey, before perſons of the firſt rank, but without meeting with any encouragement. His machines were made of wood, and the liquor employed was only water, and conſequently inferior to Dr Godfrey's in its power of extinguiſhing fire. The latter is ſaid to have mixed his water with a certain quantity of oil of vitriol, or with ſal ammoniac. Theſe machines, however, as already obſerved, are found to be only ſerviceable in the beginning of a fire. When the roof had fallen in, they had no effect.

Compoſition for extinguiſhing FIRE. For this purpoſe the following has been invented by M. Von Aken, of which the account is taken from *Nicholſon's Journal*, vol. ii. 4to.

Burnt alum	30 lbs.	Fire.
Green vitriol powdered	40	
Cinabreſe or red ochre in powder	20	
Potter's clay, or other clay, alſo powdered	200	
Water	630	

With 40 meaſures of this mixture an artificial fire was extinguiſhed under the direction of the inventor by three perſons, which would have required the labour of 20 men and 1500 meaſures of common water. Sig. Fabbroni was commiſſioned to examine the value of this invention, and found in his comparative trials with engines of equal power, worked by the ſame number of men, that the mixture extinguiſhed the materials in combuſtion in one-ſixth part leſs time, and three-eighths leſs of fluid, than when common water was uſed. He obſerved, as might indeed have been imagined from the nature of the material, that the flame diſappeared wherever the mixture fell, and that the ſaline, metallic, and earthy matters formed an impenetrable lute round the hot combuſtible matter, which prevented the acceſs of the air, and conſequently the renewal of the deſtructive proceſs.

It is ſcarcely probable that this practice in the large way, with an engine throwing upwards of 200 gallons (value about 3l. 10s.) each minute, would be thought of or adopted, or that a ſufficient ſtore of the materials would be kept in readineſs; ſince at this rate the expenditure for an hour would demand a proviſion to the amount of 210l. ſterling. But in country places the proceſs, or ſome variation of it, might be applied with ſufficient profit in the reſult; more eſpecially if it be conſidered that common ſalt or alum, or ſuch ſaline matter as can be had and mixed with the water, together with clay, chalk, or lime, ochreous earth or common mud, or even theſe laſt without any ſalt, may anſwer the purpoſe of the lute with more or leſs effect, and extinguiſh an accidental fire with much greater ſpeed and certainty than clear water would do.

Water-Engine for Extinguiſhing FIRE. See HYDROSTATICS.

In uſing this machine we have the following improvement by Dr Hoffman, which promiſes to be of great efficacy. As ſoon as the engine is in readineſs to work, ſtir into the water that immediately is to be diſcharged, ſeven or eight pounds of pearl aſhes in powder, and continue to add it in this manner as occaſion requires; taking care that it be directed againſt the timber or wainſcot, &c. juſt beginning to burn, and not waſted againſt the brick-work: or, where time will admit, diſſolve any quantity of pearl aſhes in a copper with water, and as faſt as it diſſolves, which will be in a few minutes, mix a pailful with the water in the engine, pretty often; and whatever burning wood it is played upon, will be extinguiſhed as if it was dipped in water, and will not burn afreſh in the part extinguiſhed.

Eaſy Method of Extinguiſhing FIRE *in Chimneys*. It is well known, that the inner parts of chimneys eaſily take fire; the ſoot that kindles therein emits a greater flame, according as the tunnel is more elevated, becauſe the inferior air feeds the fire. If this air could therefore be ſuppreſſed, the fire would ſoon be extinguiſhed. In order to this, ſome diſcharge a piſtol into the chimney, which produces no effect; others lay

Fire. under the chimney a copper full of water; but the vapours that riſe from it, far from extinguiſhing the fire, ſeem to give it new force. Water thrown into the chimney at top is equally of no effect, becauſe it comes down through the middle of the tunnel, and not along the ſides. It would be more adviſable to ſtop with dung the upper oriſices of the tunnel for quenching the fire. But the ſureſt and readieſt method is, to take a little gunpowder, and having humected it with ſpittle for binding it, to form it into ſmall maſſes, and ſo throw it into the heart of the chimney. When it is burnt, and has produced a conſiderable vapour, a ſecond, afterwards a third, are thrown, and ſo on, as much as is neceſſary. In a little time the fire is extinguiſhed, and, as it were, choked by this vapour; and cakes of inflamed ſoot are ſeen to fall from the tunnel, till at laſt not the leaſt veſtige of fire appears.

Securing Buildings againſt FIRE. Dr Hales propoſes to check the progreſs of fires by covering the floors of the adjoining houſes with earth. The propoſal is founded on an experiment which he made with a fir board half an inch thick, part of which he covered with an inch depth of damp garden mould, and then lighted a fire on the ſurface of the mould; though the fire was kept up by blowing, it was two hours before the board was burnt through, and the earth prevented it from flaming. The thicker the earth is laid on the floors, the better; however, Dr Hales apprehends that the depth of an inch will generally be ſufficient; and he recommends to lay a deeper covering on the ſtairs, becauſe the fire commonly aſcends by them with the greateſt velocity.

Mr Hartley made ſeveral trials in the years 1775 and 1776, in order to evince the efficacy of a method which he had invented for reſtraining the ſpread of fire in buildings. For this purpoſe thin iron plates are well nailed to the tops of the joiſts, &c. the edges of the ſides and ends being lapped over, folded together, and hammered cloſe. Partitions, ſtairs, and floors, may be defended in the ſame manner; and plates applied to one ſide have been found ſufficient. The plates are ſo thin as not to prevent the floor from being nailed on the joiſts, in the ſame manner as if this preventive were not uſed: they are kept from ruſt by being painted or varniſhed with oil and turpentine. The expence of this addition, when extending through a whole building, is eſtimated at about five per cent. Mr Hartley has a patent for this invention, and parliament has voted a ſum of money towards defraying the expence of his numerous experiments. The ſame preſervative may alſo be applied to ſhips, furniture, &c.

Lord Mahon has alſo diſcovered and publiſhed a very ſimple and effectual method of ſecuring every kind of building againſt all danger of fire. This method he has divided into three parts, viz. under-flooring, extra-lathing, and inter-ſecuring.

The method of under-flooring is either ſingle or double. In ſingle under-flooring, a common ſtrong lath of oak or fir, about one-fourth of an inch thick, ſhould be nailed againſt each ſide of every joiſt, and of every main timber, ſupporting the floor which is to be ſecured. Other ſimilar laths are then to be nailed along the whole length of the joiſts, with their ends butting againſt each other. The top of each of theſe laths or fillets ought to be at $1\frac{1}{2}$ inch below the top of the joiſts or timbers againſt which they are nailed; and they will thus form a ſort of ſmall ledge on each ſide of all the joiſts. Theſe fillets are to be well bedded in a rough plaſter hereafter mentioned, when they are nailed on, ſo that there may be no interval between them and the joiſts: and the ſame plaſter ought to be ſpread with a trowel upon the tops of all the fillets, and along the ſides of that part of the joiſts which is between the top of the fillets and the upper edge of the joiſts. In order to fill up the intervals between the joiſts that ſupport the floor, ſhort pieces of common laths, whoſe length is equal to the width of theſe intervals, ſhould be laid in the contrary direction to the joiſts, and cloſe together in a row, ſo as to touch one another: their ends muſt reſt upon the fillets, and they ought to be well bedded in the rough plaſter, but are not to be faſtened with nails. They muſt then be covered with one thick coat of the rough plaſter, which is to be ſpread over them to the level of the tops of the joiſts: and in a day or two this plaſter ſhould be trowelled over cloſe to the ſides of the joiſts, without covering the tops of the joiſts with it. Fire.

In the method of double flooring, the fillets and ſhort pieces of laths are applied in the manner already deſcribed; but the coat of rough plaſter ought to be litle more than half as thick as that in the former method. Whilſt this rough plaſter is laid on, ſome more of the ſhort pieces of laths above mentioned muſt be laid in the intervals between the joiſts upon the firſt coat, and be dipped deep in it. They ſhould be laid as cloſe as poſſible to each other, and in the ſame direction with the firſt layer of ſhort laths. Over this ſecond layer of ſhort laths there muſt be ſpread another coat of rough plaſter, which ſhould be trowelled level with the tops of the joiſts without riſing above them. The rough plaſter may be made of coarſe lime and hair; or, inſtead of hair, hay chopped to about three inches in length may be ſubſtituted with advantage. One meaſure of common rough ſand, two meaſures of ſlaked lime, and three meaſures of chopped hay, will form in general a very good proportion, when ſufficiently beat up together in the manner of common mortar. The hay ſhould be put in after the two other ingredients are well beat up together with water. This plaſter ſhould be made ſtiff; and when the flooring boards are required to be laid down very ſoon, a fourth or fifth part of quicklime in powder, formed by dropping a ſmall quantity of water on the limeſtone a little while before it is uſed, and well mixed with this rough plaſter, will cauſe it to dry very faſt. If any cracks appear in the rough plaſter work near the joiſts when it is thoroughly dry, they ought to be cloſed by waſhing them over with a bruſh wet with mortar waſh: this waſh may be prepared by putting two meaſures of quicklime and one of common ſand in a pail, and ſtirring the mixture with water till it becomes of the conſiſtence of a thin jelly.

Before the flooring boards are laid, a ſmall quantity of very dry common ſand ſhould be ſtrewed over the plaſter work, and ſtruck ſmooth with a hollow rule, moved in the direction of the joiſts, ſo that it may lie rounding between each pair of joiſts. The plaſter work and ſand ſhould be perfectly dry before the boards are laid, for fear of the dry rot. The method

of

Fire. of under-flooring may be fucceſsfully applied to a wooden ſtaircaſe; but no ſand is to be laid upon the rough plaſter work. The method of extra-lathing may be applied to ceiling joiſts, to ſloping roofs, and to wooden partitions.

The third method, which is that of inter-ſecuring, is very ſimilar to that of under-flooring; but no ſand is afterwards to be laid upon it. Inter-ſecuring is applicable to the ſame parts of a building as the method of extra-lathing, but it is ſeldom neceſſary.

Lord Mahon has made ſeveral experiments in order to demonſtrate the efficacy of theſe methods. In moſt houſes it is only neceſſary to ſecure the floors; and the extra expence of under-flooring, including all materials, is only about ninepence per ſquare yard, and with the uſe of quicklime a little more. The extra expence of extra-lathing is no more than ſixpence per ſquare yard for the timber ſide walls and partitions; but for the ceiling about ninepence per ſquare yard. But in moſt houſes no extra lathing is neceſſary.

Fire-Eater. We have a great number of mountebanks who have procured the attention and wonder of the public by eating of fire, walking on fire, waſhing their hands in melted lead, and the like tricks.

The moſt celebrated of theſe was our countryman Richardſon, much talked of abroad. His ſecret, as related in the *Journal des Sçavans*, of the year 1680, conſiſted in a pure ſpirit of ſulphur, wherewith he rubbed his hands, and the parts that were to touch the fire; which burning and cauterizing the epidermis, hardened and enabled the ſkin to reſiſt the fire.

Indeed this is no new thing: Amb. Parée aſſures us he has tried it on himſelf; that after waſhing the hands in urine, and with unguentum aureum, one may ſafely waſh them in melted lead.

He adds alſo, that by waſhing his hands in the juice of onions, he could bear a hot ſhovel on them while it melted lead.

Fire, in *Theology*. See Hell.

We read of the ſacred fire in the firſt temple of Jeruſalem, which came down from heaven: it was kept with the utmoſt care, and they were forbidden to carry any ſtrange fire into the temple. This fire is one of the five things which the Jews confeſs were wanting in the ſecond temple.

The Pagans had their ſacred fires, which they kept in their temples with the moſt religious care, and which were never to be extinguiſhed. Numa was the firſt who built a temple to Fire as a goddeſs at Rome, and inſtituted an order of prieſteſſes for the preſervation of it. See Vestals.

Fire was the ſupreme god of the Chaldeans; the Magi were worſhippers of fire; and the Greeks and Armenians ſtill keep up a ceremony called the *holy fire*, upon a perſuaſion that every Eaſter day a miraculous fire deſcends from heaven into the holy ſepulchre, and kindles all the lamps and candles there.

Fire kindled ſpontaneouſly in the Human Body. See *Extraordinary Caſes of* Burning.

Fire-Barrel. See Fire-*Ship*, Note (B).

Fire-Bavins. Ibid. Note (D).

Fire Arrow, in naval artillery, is a ſmall iron dart furniſhed with ſprings and bars, together with a match impregnated with ſulphur and powder, which is wound about its ſhaft. It is intended to fire the ſails of the enemy, and is for this purpoſe diſcharged from a muſquetoon or ſwivel gun. The match being kindled by the exploſion, communicates the flame to the ſail againſt which it is directed, where the arrow is faſtened by means of its bars and ſprings. This weapon is peculiar to hot climates, particularly the Weſt Indies, where the ſails being extremely dry by reaſon of the great heat, they inſtantly take fire, and of courſe ſet fire to the maſts and rigging, and laſtly to the veſſel itſelf. Fire

Fire-Ball, in artillery, a compoſition of meal powder, ſulphur, ſalipetre, pitch, &c. about the bigneſs of a hand grenade, coated over with flax, and primed with the ſlow compoſition of a fuze. This is to be thrown into the enemy's works in the night time, to diſcover where they are, or to fire houſes, galleries, or blinds of the beſiegers; but they are then armed with ſpikes, or hooks of iron, that they may not roll off, but ſtick or hang where they are deſired to have any effect. See *Fire*-Balls, and *Light*-Balls.

Balls of Fire, in *Meteorology*, a kind of luminous bodies generally appearing at a great height above the earth, with a ſplendour ſurpaſſing that of the moon; and ſometimes equalling her apparent ſize. They generally proceed in this hemiſphere from north to ſouth with vaſt velocity, frequently breaking into ſeveral ſmaller ones, ſometimes vaniſhing with a report, ſometimes not.

Theſe luminous appearances no doubt conſtitute one part of the ancient prodigies, blazing ſtars or comets, which laſt they ſometimes reſemble in being attended with a train; but frequently they appear with a round and well-defined diſk. The firſt of theſe of which we have any accurate account, was obſerved by Dr Halley and ſome other philoſophers at different places, in the year 1719. From the ſlight obſervations they could take of its courſe among the ſtars, the perpendicular height of this body was computed at about 70 miles from the ſurface of the earth. The height of others has alſo been computed, and found to be various; though in general it is ſuppoſed to be beyond the limits aſſigned to our atmoſphere, or where it loſes its refractive power. The moſt remarkable of theſe on record appeared on the 18th of Auguſt 1783, about nine o'clock in the evening. It was ſeen to the northward of Shetland, and took a ſouthern direction for an immenſe ſpace, being obſerved as far as the ſouthern provinces of France, and one account ſays that it was ſeen at Rome alſo. During its courſe it appears frequently to have changed its ſhape; ſometimes appearing in the form of one ball, ſometimes of two or more; ſometimes with a train, ſometimes without one. It paſſed over Edinburgh nearly in the zenith, and had then the appearance of a well-defined round body, extremely luminous, and of a greenith colour; the light which it diffuſed on the ground giving likewiſe a greenith caſt to objects. After paſſing the zenith it was attended by a train of conſiderable length, which continually augmenting, at laſt obliterated the head entirely; ſo that it looked like a wedge, flying with the obtuſe end foremoſt. The motion was not apparently ſwift, by reaſon of its great height; though in reality it muſt have moved with great rapidity, on account of the vaſt ſpace it travelled over in a ſhort time. In other places its appearance

Fire. pearance was very different. At Greenwich we are told, that "two bright balls parallel to each other led the way, the diameter of which appeared to be about two feet; and were followed by an expulſion of eight others, not elliptical, ſeeming gradually to mutilate, for the laſt was ſmall. Between each two balls a luminous ſerrated body extended, and at the laſt a blaze iſſued which terminated in a point. Minute particles dilated from the whole. The balls were tinted firſt by a pure bright light, then followed a tender yellow, mixed with azure, red, green, &c.; which, with a coalition of bolder tints, and a reflection from the other balls, gave the moſt beautiful rotundity and variation of colours that the human eye could be charmed with. The ſudden illumination of the atmoſphere, and the form and ſingular tranſition of this bright luminary, tended much to make it awful: nevertheleſs, the amazing vivid appearance of the different balls, and other rich connective parts not very eaſy to delineate, gave an effect equal to the rainbow in the full zenith of its glory."

Dr Blagden, in a paper on this ſubject in the 74th volume of the Philoſophical Tranſactions, has not only given a particular account of this and other meteors of the kind, but added ſeveral conjectures relating to the probable cauſes of them. The firſt thing which occurred to philoſophers on this ſubject was, that the meteors in queſtion were burning bodies riſing from the ſurface of the earth, and flying along the atmoſphere with great rapidity. But this hypotheſis was ſoon abandoned, on conſidering that there was no power known by which ſuch bodies could either be raiſed to a ſufficient height, or projected with the velocity of the meteors. The next hypotheſis was, that they do not conſiſt of one ſingle body, but of a train of ſulphureous vapours, extending a vaſt way through the atmoſphere, and being kindled at one time diſplay the luminous appearances in queſtion by the fire running from one end of the train to the other. To this hypotheſis, which was invented by Dr Halley, Dr Blagden objects that no juſt explanation is given of the nature of the vapours themſelves, the manner in which they are raiſed up, or in which they can be regularly arranged in ſtraight lines of ſuch vaſt extent; or how they can be ſuppoſed to burn in ſuch rarefied air. "Indeed, (ſays he) it is very difficult to conceive how vapours could be prevented, in thoſe regions where there is in a manner no preſſure, from ſpreading out on all ſides in conſequence of their natural elaſticity, and inſtantly loſing that degree of denſity which ſeems neceſſary for inflammation. Beſides, it is to be expected, that ſuch trains would ſometimes take fire in the middle, and thus preſent the phenomenon of two meteors at the ſame time, receding from one another in a direct line."

For theſe and other reaſons this hypotheſis of Dr Halley was abandoned, and another ſubſtituted in its place. This was, that the meteors we ſpeak of are permanent ſolid bodies, not riſing from the earth, but revolving round it in very eccentric orbits, and thus in their perigeon moving with inconceivable rapidity. But the doctor ſhows, that, even on this ſuppoſition, the velocity of ſuch bodies muſt ſcarce be one third of that with which fire-balls move, and which has been calculated at upwards of 1000 miles per minute. The hypotheſis is likewiſe liable to a number of other objections which cannot be anſwered, particularly from the variations in their appearance; for it is impoſſible to ſhow in what manner one ſolid and permanent body could aſſume the appearance of eight or ten, as was the caſe with the meteor of 1783: nor can it be ſhown why a body, which in paſſing over Edinburgh appeared with a diſk evidently leſs than that of the ſun, ſhould, in paſſing over Greenwich, aſſume the appearance of *two* bodies, each of which had a diſk conſiderably larger than the apparent diſk of that luminary. To obviate, in ſome meaſure, objections of this kind, it has been ſuppoſed that the revolving bodies are ſurrounded by a kind of electrical atmoſphere by which they are rendered luminous; "but (ſays the doctor) I think, whoever carefully peruſes the various accounts of fire-balls, and eſpecially ours of the 18th of Auguſt, when it divided, will perceive that their phenomena do not correſpond with the idea of a ſolid nucleus involved in a ſubtile fluid, any more than with the idea of another learned gentleman, that they become luminous by means of a contained fluid, which occaſionally explodes through the thick ſolid outer ſhell."

Another hypotheſis, which Dr Blagden has not mentioned, is, that the meteors in queſtion are a kind of bodies which take fire as ſoon as they come within the atmoſphere of the earth. But this cannot be ſuppoſed, without implying a previous knowledge of theſe bodies, which it is altogether impoſſible we can have. The only opportunity we have of ſeeing them is when they are on fire. Before that time they are in an inviſible and unknown ſtate; and it is ſurely improper to argue concerning them in this ſtate, or pretend to determine any one of their properties, when we have it not in our power to ſee or inveſtigate them in the leaſt. As the meteors therefore never manifeſt themſelves to our ſenſes but when they are on fire, the only rational concluſion we can draw from thence is, that they have no exiſtence in any other ſtate; and conſequently that their ſubſtance muſt be compoſed of that fluid which, when acting after a certain manner, becomes luminous and ſhows itſelf as fire; remaining inviſible and eluding our reſearches in every other caſe. On this hypotheſis we muſt conclude that the fire-balls are great bodies of electric matter, moving from one part of the heavens where, to our conception, it is ſuperabundant, to another where it is deficient. This opinion is adopted by Dr Blagden for the following reaſons:

1. On account of their prodigious velocity, which is not leſs than 1200 miles in a minute, and ſeems incompatible with any other ſubſtance we know beſides the electric fluid. "This (ſays he) is perhaps the only caſe in which the courſe or direction of that fluid is rendered perceptible to our ſenſes, in conſequence of the large ſcale on which theſe meteors move."

2. Various electrical phenomena have been obſerved to attend them, ſuch as lambent fires ſettling upon men, horſes, &c. and ſparks coming from them, "or the whole meteor itſelf (adds our author), it is ſaid, have damaged ſhips, houſes, &c. after the manner of lightning." This laſt circumſtance, however, we can believe only of another kind of fire-balls, of which we ſhall afterwards treat, which keep at a ſmall diſtance from the earth, or run along its ſurface; for the great

meteors

Fire. meteors of which we now ſpeak, flying at the diſtance of 50 or 60, or more, miles from the ſurface of the earth, cannot be leſs from their apparent ſize than a mile or a mile and a half in diameter. Such an immenſe body of electric matter deſcending on the earth, would by its exploſion ruin a large tract of country; and there is no probability that when engendered in ſuch a rare atmoſphere it could break through the whole body of groſs and denſe air which lies between theſe regions and the earth, and which we know reſiſts the paſſage of the electric fluid very ſtrongly. Notwithſtanding this, there is no impoſſibility that the atmoſphere may be electrified to a great degree by ſuch a meteor paſſing over it; and thus electrified appearances may attend theſe bodies without any actual emiſſion of their ſubſtance, as Dr Blagden ſuppoſes. "If there be really (ſays he) any hiſſing noiſe heard while the meteors are paſſing, it ſeems explicable on no other ſuppoſition than that of ſtreams of electric matter iſſuing from them, and reaching the earth with a velocity equal to that of the meteor, namely, in two or three ſeconds. Accordingly, in one of our late meteors, the hiſſing was compared to that of electricity iſſuing from a conductor. The ſparks flying off ſo perpetually from the body of fire-balls may poſſibly have ſome connexion with theſe ſtreams. In the ſame manner the ſound of exploſions may perhaps be brought to us quicker than if it were propagated to us by the air alone. Should theſe ideas be well founded, the change of direction, which meteors ſeem at times to undergo, may poſſibly be influenced by the ſtate of the ſurface of the earth over which they are paſſing, and to which the ſtreams are ſuppoſed to reach. A ſimilar cauſe may occaſion the apparent exploſion, the opening of more channels giving new vent and motion to the electric fluid. May not the deviation and exploſion which appear to have taken place in the fire-ball of the 18th of Auguſt over Lincolnſhire, have been determined by its approach towards the fens, and an attraction produced by that large body of moiſture?

The exploſion mentioned by our author over Lincolnſhire does not ſeem to have been the only one which happened during the courſe of this meteor. Several people heard reports after it had vaniſhed; and theſe were ſometimes ſingle and ſometimes double. At Edinburgh two reports were heard, the one immediately following the other, at the diſtance of ſix or ſeven minutes after the meteor had paſſed. Theſe reports no doubt indicated a temporary diſſolution of the body; but it is by no means probable that the diſſolution could have taken place either on account of the ſtate of the earth or atmoſphere. We muſt conſider that both earth and atmoſphere are always full of electric fluid; and if there happens to be what is called a *deficiency* in one of them, the other inſtantly ſupplies it. It is impoſſible, therefore, that either the earth or atmoſphere could receive ſuch an immenſe additional quantity in one part without a vent being provided for it ſomewhere elſe. In thunder ſtorms we naturally conclude that a vaſt quantity of electrical matter is put in motion; but from the effects of lightning it appears that this quantity muſt be very trifling in compariſon with what the meteor we now ſpeak of contained. A violent flaſh of lightning has been known to perforate a looking-glaſs, and make only a hole of about an inch diameter. Now we have no reaſon to ſuppoſe that the flaſh, tremendous as it might appear to our eyes, was any other than an electric ſpark of an inch in diameter. The meteor, on the other hand, appears not to have been leſs than a mile in diameter; ſo that the diſproportion betwixt it and a ſingle flaſh of lightning appears almoſt beyond calculation; and we may reaſonably conclude that it could not have been equalled by 10,000 thunder-ſtorms. Had this amazing body of electric fire deſcended through the atmoſphere and diſſipated itſelf on the fens of Lincolnſhire, it muſt have produced the moſt violent and unheard-of effects, not only in that place, but probably throughout the whole iſland. Its diſſipation muſt therefore have been in the higher regions, where there was ample ſpace to receive it; and where its exploſion, whatever concuſſion it might make among the ethereal matter itſelf, could not affect our earth or atmoſphere in any remarkable degree. Its re-appearance was owing to the ſame tendency in the fluid to circulate which had originally produced it; and which probably was the violent earthquake in Calabria, and the eruption in Iceland. Fire.

3. Another argument adduced by Dr Blagden in favour of the electrical origin of fire-balls, is their connexion with the aurora borealis, and the reſemblance they bear to theſe phenomena, which are now almoſt univerſally allowed to be electrical. "Inſtances (ſays he) are recorded, where northern lights have been ſeen to join, and form luminous balls, darting about with great velocity, and even leaving a train behind them like the common fire-balls. This train I take to be nothing elſe but the rarefied air left in ſuch an electrified ſtate as to be luminous; and ſome ſtreams of the northern lights are very much like it." The aurora borealis appears to occupy as high, if not a higher region above the ſurface of the earth, as may be judged from the very diſtant countries to which it has been viſible at the ſame time: indeed the great accumulation of electric matter ſeems to lie beyond the verge of our atmoſphere, as eſtimated by the ceſſation of twilight. Alſo with the northern lights a hiſſing noiſe is ſaid to be heard in ſome very cold climates: Gmelin ſpeaks of it in the moſt pointed terms, as frequent and very loud in the north-eaſtern parts of Siberia; and other travellers have related ſimilar facts."

4. Our author thinks that the ſtrongeſt argument for the electrical origin of theſe meteors is the direction of their courſe, which is conſtantly either from the north or north-weſt quarter of the heavens, or towards it; or, as our author thinks, nearly in the direction of the magnetical meridian. Such a courſe, however, ſeems only to belong to the very large fire-balls of which we now ſpeak; the ſmaller ones, called *Falling Stars*, being moved in all directions; "perhaps (ſays the doctor), becauſe they come further within the verge of our atmoſphere, and are thereby expoſed to the action of extraneous cauſes. That the ſmaller ſort of meteors, ſuch as ſhooting ſtars, are really lower down in the atmoſphere, is rendered very probable by their ſwifter apparent motion: perhaps it is this very circumſtance which occaſions them to be ſmaller, the electric fluid being more divided in more reſiſting air. But as theſe maſſes of electric matter which move

where

Fire. where there is ſcarce any reſiſtance, ſo generally affect the direction of the magnetic meridian, the ideas which have been entertained of ſome analogy between theſe two obſcure powers of nature ſeem not altogether without foundation. If the foregoing conjectures be juſt, diſtinct regions are allotted to the electrical phenomena of our atmoſphere. Here below we have thunder and lightning, from the unequal diſtribution of the electric fluid among the clouds; in the loftier regions, whither the clouds never reach, we have the various gradations of falling ſtars; till, beyond the limits of our corpuſcular atmoſphere, the fluid is put into motion in ſufficient maſſes, to hold a determined courſe, and exhibit the different appearances of what we call *fire-balls*; and probably at a ſtill greater elevation above the earth, the electricity accumulates in a lighter and leſs condenſed form, to produce the wonderfully diverſified ſtreams and coruſcations of the aurora borealis."

The paper from whence theſe extracts are taken was written before Mr Morgan's account of the non-conducting power of a perfect vacuum made its appearance. The meteor in queſtion, and others of the ſame nature, afford a proof of the theory of the deficiency of electric fluid propoſed by ſome. Dr Halley, ſpeaking of the fire-ball of 1719, the height of which he calculated at very little leſs than 70 miles, expreſſes his ſurpriſe that ſound ſhould be propagated through a medium near 300,000 times rarer than the common air, and the next thing to a perfect vacuum. Now it remains, and for ever will remain, to be proved, that Mr Morgan's moſt perfect vacuum, formed by boiling quickſilver in a tube ever ſo long, contains a medium *more* than 300,000 times rarer than the common atmoſphere. From Mr Cavallo's experiments it appears, that when air is only rarefied 1000 times, the electric light is exceſſively weak; ſo that there is not the leaſt probability that in an aerial medium 300,000 times rarer than the preſent, if indeed ſuch a medium can exiſt, there could be any light made viſible in the ordinary experiments. We ſee, however, by the many examples of meteors which have occurred at prodigious heights in the atmoſphere, that the electric light in ſuch a rarefied atmoſphere is not only viſible, but acts as vigorouſly in every reſpect as if it were on the ſurface of the earth. This circumſtance therefore affords a complete demonſtration of the fallacy of Mr Morgan's argument, and a direct proof that the electric fluid pervades ſpace as completely diveſted of air as the beſt artificial vacuum we can make; nay, where it is generally believed by mathematicians that the atmoſphere has ceaſed altogether. His other arguments drawn *à priori* are ſtill more inconcluſive than that we have juſt mentioned. He tells us, that if a vacuum was a conductor, the whole quantity of electric matter contained in the earth and atmoſphere would be perpetually flying off through the regions of infinite ſpace, as being ſurrounded by a boundleſs conductor. But even this does not follow, though we ſhould ſuppoſe theſe regions to be an abſolute vacuity; for we know that electricity does not fly to a conducting ſubſtance merely becauſe it is a conductor, but becauſe it opens a paſſage to ſome place whither it has a tendency to go though the conductor was not there. Now, on the preſent hypotheſis, as the conductor would lead to *no place* to which the electric matter had any previous tendency, we cannot aſſign any reaſon why it ſhould acquire a tendency to fly off merely on account of the neighbourhood of a conductor, even though boundleſs. His other objection (that, on the ſuppoſition of a vacuum being capable of conducting electricity, the whole ſpace in the univerſe would be filled with electric fluid) may be admitted in its fulleſt extent, without any detriment whatever to ſcience; and indeed, if we allow the electric fluid to be only a modification of the light of the ſun, we muſt own that the whole univerſe is filled with it. The meteors in queſtion then will be no other than diſcharges of electricity from one part of the celeſtial ſpaces to another, ſimilar to the diſcharges between the poſitive and negative ſide of an electrified bottle; thus intimating, that a circulation has taken place in the fluid, which the meteor at once completes and puts an end to. See METEOROLOGY. Fire.

Beſides theſe already juſt mentioned of ſuch vaſt magnitude, there are others much ſmaller and nearer the ſurface of the earth, rolling upon it, or falling upon it, exploding with violence, as is the caſe with thoſe which appear in the time of thunder, and frequently produce miſchievous effects. One of theſe is mentioned by ſome authors as falling in a ſerene evening in the iſland of Jamaica; exploding as ſoon as it touched the ſurface of the ground, and making a conſiderable hole in it. Another is mentioned by Dr Prieſtley as rolling along the ſurface of the ſea, then riſing and ſtriking the top-maſt of a man of war, exploding, and damaging the ſhip. In like manner, we hear of an electrified cloud at Java in the Eaſt Indies; whence, without any thunder ſtorm, there iſſued a vaſt number of fire-balls which did incredible miſchief. This laſt phenomenon points out to us the true origin of balls of this kind, viz. an exceſſive accumulation of electricity in one part, or a violent tendency to circulate, when at the ſame time the place where the motion begins is at ſo great a diſtance, or meets with other obſtacles of ſuch a nature, that it cannot eaſily get thither. Urged on, however, by the vehement preſſure from behind, it is forced to leave its place; but being equally unable to diſplace the great quantity of the ſame fluid, which has no inclination to move the ſame way with itſelf, it is collected into balls, which run hither and thither, according as they meet with conductors capable of leading them, into ſome part of the circle. This is even confirmed by an experiment related at the end of Dr Prieſtley's fifth volume on Air. He relates, that a gentleman having charged, with a very powerful machine, a jar, which had the wire ſupporting the knob of a conſiderable length, and paſſed through the glaſs tube, a globe of fire was ſeen to iſſue out of it. This globe gradually aſcended up the glaſs tube till it came to the top of the knob, where it ſettled, turning ſwiftly on its axis, and appearing like a red-hot iron ball of three quarters of an inch diameter. On continuing to turn the machine, it gradually deſcended into the jar; which it had no ſooner done, than there enſued a moſt violent exploſion and flaſh, the jar being diſcharged and broken at the ſame time. This experiment, however, is ſingular in its kind; for neither the gentleman who performed it, nor any other, has yet been able to repeat it. Single as it is, however, we may yet gather from it, that a fire-ball will be the conſequence of a very

Fire. very violent electrification of any ſubſtance, provided at the ſame time that the air be in a very non-conducting ſtate, ſo that the electricity may not evaporate into it as faſt as it is collected; for this would produce only lucid ſtreams and flaſhes, as in the common experiments with the Leyden phial; and it is probably an inattention to this circumſtance which has hitherto prevented the repetition of the experiment above mentioned. The caſe is the ſame in thunder ſtorms, where an exceſſive accumulation of electric matter always produces fire-balls, the moſt miſchievous kind of lightning, as is explained under that article.

With regard to the uſes which fire-balls ſerve in the ſyſtem of nature, it is plain that they are the means of preſerving the equilibrium in the electric fluid in the atmoſphere, which would otherwiſe produce the moſt dreadful tempeſts. As there muſt be a conſtant current of electric matter through the bowels of the earth from the equator to the poles, and from the poles to the equator, through the atmoſphere, the great meteors ſerve for keeping up the equilibrium in this great atmoſpherical current, while the ſmaller ones anſwer a like purpoſe in the general maſs of electric matter diſperſed over the ſurface of the earth, and therefore are ſeen to move in all directions, as the equilibrium happens to require them in different parts. With regard to thoſe which are obſerved in the lower regions of the earth, or rolling on the ſurface of the ground itſelf, they undoubtedly anſwer purpoſes of a ſimilar kind in theſe lower regions; for as fire-balls in general are produced by a great exceſs of electricity in one place, there muſt of courſe be an equal deficiency in another; and to reſtore the equilibrium, or, to ſpeak more properly, to prevent a dangerous commotion from taking place throughout the whole maſs of electric fluid, the fire-ball breaks forth, and either puts a ſtop at once to the diſturbance by an exploſion, or by a ſilent and inviſible evaporation. From ſome accounts indeed it would ſeem that even the large celeſtial meteors detached part of their ſubſtance to accompliſh this purpoſe; though, for the reaſons already given, it would ſeem more probable that they operated by electrifying the atmoſphere, or ſetting the fluid contained in it in motion, ſo as to produce ſmall fire-balls of itſelf, rather than by detaching any part of their own bodies to ſuch a diſtance. Dr Blagden, in the paper above quoted, gives an account of an appearance of this kind. It was deſcribed in a letter to Sir Joſeph Banks from the Abbé Mann, director of the academy at Bruſſels. "It happened (ſays the Abbé) at Mariekercke, a ſmall village on the coaſt, about half a mile weſt of Oſtend. The curate of the village was ſitting in the duſk of the evening with a friend, when a ſudden light ſurpriſed them, and, immediately after, a ſmall ball of light-coloured flame came through a broken pane of glaſs, croſſed the room where they were ſitting, and fixed itſelf on the chink of a door oppoſite to the window where it entered, and there died gradually away. It appeared to be a kind of phoſphoric light carried along by the current of air. The curate and his friend, greatly ſurpriſed at what they ſaw, apprehended fire in the neighbourhood; but going out, found that the fire which had come in through the window had been detached from a large meteor in its paſſage."

Fire-Cocks. Churchwardens in London and within the bills of mortality, are to fix fire-cocks at proper Fire. diſtances in ſtreets, and keep a large engine and hand-engine for extinguiſhing fire, under the penalty of 10l. ſtat. 6 Ann. c. 31.

On the breaking out of any fire in London or Weſtminſter, the conſtables and beadles of pariſhes ſhall repair to the place with their ſtaves, and aſſiſt in extinguiſhing it, and cauſe the people to work for that end, &c.

Fire-Engine. See *Steam-Engine.*

Fire-Flair, in *Ichthyology*. See Raja, Ichthyology *Index.*

Fire-Flies, a ſpecies of flies common in Guiana, of which there are two ſpecies. The largeſt is more than an inch in length, having a very large head connected with the body by a joint of a particular ſtructure, with which at ſome times it makes a loud knock, particularly when laid on its back. The fly has two feelers or horns, two wings, and ſix legs. Under its belly is a circular patch, which, in the dark, ſhines like a candle; and on each ſide of the head near the eyes is a prominent, globular, luminous body, in ſize about one-third larger than a muſtard ſeed. Each of theſe bodies is like a living ſtar, emitting a bright, and not ſmall, light; ſince two or three of theſe animals, put into a glaſs veſſel, afford light ſufficient to read without difficulty, if placed cloſe to the book. When the fly is dead, theſe bodies will ſtill afford conſiderable light, though it is leſs vivid than before; and if bruiſed, and rubbed over the hands or face, they become luminous in the dark, like a board ſmeared over with phoſphorus. They have a reddiſh brown or cheſnut colour; and live in rotten trees in the day, but are always abroad in the night. The other kind is not more than half as large as the former: their light proceeds from under their wings, and is ſeen only when they are elevated, like ſparks of fire appearing or diſappearing at every ſecond. Of theſe the air is full in the night, though they are never ſeen in the day. They are common not only in the ſouthern but in the northern parts of America, during the ſummer.

Fire-Lock, or *Fuſil*, a ſmall gun which fires with a flint. It is diſtinguiſhed from an old muſket, or match-lock, which was fired with a match. The firelock is now in common uſe in the European armies.

Fire-Philoſophers, or *Philoſophi per ignem*, a fanatical ſect of philoſophers who appeared towards the cloſe of the 16th century, and made a figure in almoſt all the countries of Europe. The diſtinguiſhing tenet from which they derived this appellation was, that the intimate eſſences of natural things were only to be known by the trying efforts of fire, directed in a chemical proceſs. They were alſo called *Theoſophiſts*, from their declaring againſt human reaſon as a dangerous and deceitful guide, and repreſenting a divine and ſupernatural illumination as the only means of arriving at truth; they were likewiſe denominated *Paracelſiſts*, from the name of Paracelſus, the eminent phyſician and chemiſt, who was the chief ornament and leader of this extraordinary ſect. It was patronized in England by Robert Flodd or Fludd, who endeavoured to illuſtrate the philoſophy of Paracelſus in a great number of treatiſes: in France it was zealouſly propagated by Rivier; in Denmark, by Severinus; in Germany, by Kunrath, an eminent phyſician of Dreſden; and in other

Fire. other countries by warm and ſucceſsful votaries, who aſſumed a ſtriking air of piety and devotion, and propoſed to themſelves no other end than the advancement of the divine glory, and the reſtoration of peace and concord in a divided church: accordingly they were joined by ſeveral perſons eminent for their piety, and diſtinguiſhed by their zeal for the advancement of true religion. One of the moſt celebrated of theſe was Daniel Hoffman, profeſſor of divinity in the univerſity of Helmſtadt, who, availing himſelf of ſome unguarded paſſages in the writings of Luther, extravagantly maintained, that philoſophy was the mortal enemy of religion; that truth was diviſible into two branches, the philoſophical and theological; and that what was true in philoſophy was falſe in theology. Hoffman, was afterwards obliged, by the interpoſition of Henry Julius, duke of Brunſwick, to retract his invectives againſt philoſophy, and to acknowledge in the moſt open manner the harmony and union of ſound philoſophy with true and genuine theology.

Fire-Places are contrivances for communicating heat to rooms, and alſo for anſwering various purpoſes of art and manufacture. See CHIMNEY, FURNACE, and STOVE.

The ingenious Dr Franklin, having recounted the inconveniences and advantages of fire-places in common uſe, propoſes a new contrivance for this purpoſe, called the *Pennſylvania fire-place*. 1. This machine conſiſts of a bottom-place, or hearth-piece, fig. 1. Plate CCXVII. with a riſing moulding before for a fender, two perforated ears *F*, *G*, for receiving two ſcrew-rods; a long air-hole *a a*, through which the outward air paſſes into an air-box; and three ſmoke-holes, repreſented by dark ſquares in *BC*, through which the ſmoke deſcends and paſſes away; beſides, double ledges for receiving between them the lower edges of the other plates. 2. A back-plate without holes, and furniſhed with a pair of ledges to receive, 3. The two ſide-plates, each of which has a pair of ledges to receive the ſide edges of the front plate, with a ſhoulder on which it reſts; two pair of ledges to receive the ſide edges of the two middle plates which form the air-box, and an oblong air-hole near the top, through which the air warmed in the box is diſcharged into the room, and a wing or bracket as *H*, and a ſmall hole as *R*, for the axis of the regiſter to turn in. See fig. 2. which repreſents one of theſe plates. 4. An air-box, compoſed of the two middle plates *DE* and *FG*, fig. 3. and 4. The firſt has five thin ledges or partitions caſt on it, the edges of which are received into ſo many pairs of ledges caſt in the other: the tops of all the cavities formed by theſe thin deep ledges are alſo covered by a ledge of the ſame form and depth caſt with them; ſo that when the plates are put together, and the joints luted, there is no communication between the air-box and the ſmoke. In the winding paſſages of this box, freſh air is warmed as it paſſes into the room. 5. A front plate, which is arched on the under ſide, and ornamented with foliages, &c. 6. A top plate with a pair of ears, *MN*, (fig. 5.) anſwerable to thoſe in the bottom plate, and perforated for the ſame purpoſe. It has alſo a pair of ledges running round the under ſide to receive the top edges of the front, back, and ſide plates. The air-box does not reach up to the top plate by $2\frac{1}{2}$ inches.

All theſe plates are of caſt iron; and when they are Fire. all in their proper places, they are bound firmly together by a pair of ſlender rods of wrought iron with ſcrews, and the machine appears as in fig. 5. There are alſo two thin plates of wrought iron, viz. 7. The ſhutter which is of ſuch a length and breadth as to cloſe well the opening of the fire-place, and ſerving to blow up the fire, and to ſecure it in the night. It is raiſed or depreſſed by means of two braſs knobs, and ſlides in a groove left between the foremoſt ledge of the ſide plates and the face of the front plate. 8. The regiſter, which is placed between the back plate and air-box, and furniſhed with a key; ſo that it may be turned on its axis, and made to lie in any poſition between level and upright. The operation of this machine, and the method of fixing it, may be underſtood by obſerving the profile of the chimney and fire-places in fig. 6. *M* is the mantle-piece or breaſt of the chimney; *C* the funnel; *B* the falſe back, made of brick work in the chimney, four inches or more from the true back, from the top of which a cloſing is to be made over to the breaſt of the chimney, that no air may paſs into the chimney except that which goes under the falſe back, and up behind it: *E* the true back of the chimney; *T* the top of the fire-place; *F* the front of it; *A* the place where the fire is made; *D* the air-box; *K* the hole in the ſide plate, through which the warmed air is diſcharged out of the air-box into the room; *H* the hollow, formed by removing ſome bricks from the hearth under the bottom plate filled with freſh air, entering at the paſſage *I*, and aſcending into the air-box through the air-hole in the bottom plate near *G*, the partition in the hollow, deſigned to keep the air and ſmoke apart; *P* the paſſage under the falſe back, and part of the hearth for the ſmoke; and the arrows in the figure ſhow the courſe of the ſmoke. The fire being made at *A*, the flame and ſmoke will aſcend, ſtrike the top *T*, and give it a conſiderable heat; the ſmoke will turn over the air box, and deſcend between it and the back plate to the holes near *G* in the bottom plate, heating in its paſſage all the plates of the machine; it will then proceed under and behind the falſe back, and riſe into the chimney. The air of the room contiguous to the ſeveral plates, and warmed by them, becomes ſpecifically lighter than the other air in the room, and is obliged to riſe; but being prevented by the cloſure over the fire-place from going up the chimney, is forced out into the room, and riſing by the mantle-piece to the ceiling, is again driven down gradually by the ſteam of newly-warmed air that follows; and thus the whole room becomes in a little time equally warmed. The air alſo, warmed under the bottom plate and in the air-box, riſes and comes out of the holes in the ſide plates, thus warming and continually changing the air of the room. In the cloſing of the chimney, a ſquare opening for a trap-door ſhould be left for the ſweeper to go up: the door may be made of ſlate or tin, and ſo placed, that by turning up againſt the back of the chimney when open, it cloſes the vacancy behind the falſe back, and ſhoots the ſoot that falls in ſweeping out upon the hearth. It will alſo be convenient to have a ſmall hole, about five or ſix inches ſquare, cut near the ceiling through into the funnel, and provided with a ſhutter; by occaſionally opening which,

Fire. which, the heated air of the room and ſmoke of tobacco, &c. may be carried off without incommoding the company. For a farther account of the manner of uſing this fire-place, the advantages attending it, anſwers to objections, and directions to the bricklayer in fixing it, the curious reader may conſult Franklin's Letters and Papers on Philoſophical Subjects, p. 284—318. edit. 1769. Fire.

Fire-Pots, in the military art, ſmall earthen pots, into which is put a charged grenade, and over that powder enough till the grenade is covered; then the pot is covered with a piece of parchment, and two pieces of match acroſs lighted: this pot being thrown by a handle of matches where it is deſigned, it breaks and fires the powder, and burns all that is near it, and likewiſe fires the powder in the grenade, which ought to have no fuſe, to the end its operations may be the quicker.

Fire-Reeds. See the next article, Note (C)

Fire-Ship, an old veſſel filled with combuſtible materials, and fitted with grappling irons to hook, and ſet fire to, the enemies ſhips in battle, &c.

As there is nothing particular in the conſtruction of this ſhip, except the apparatus by which the fire is inſtantly conveyed from one part to another, and from thence to the enemy, it will be ſufficient to deſcribe the fire-room, where theſe combuſtibles are encloſed, together with the inſtruments neceſſary to grapple the ſhip intended to be deſtroyed.

The fire-room is built between decks, and limited on the after part by a *bulk-head*, *L*, behind the main-maſt, from which it extends quite forward, as repreſented in Plate CCXVII. The train encloſed in this apartment is contained in a variety of wooden troughs, *D*, *G*, which interſect each other in different parts of the ſhip's length; being ſupported at proper diſtances by croſs pieces and ſtanchions. On each ſide of the ſhip are ſix or ſeven ports, *H*, about 18 inches broad and 15 inches high; and having their lids to open downward, contrary to the uſual method.

Againſt every port is placed an iron chamber (A) which, at the time of firing the ſhip, blows out the port-lid, and opens a paſſage for the flame. Immediately under the main and fore-ſhrouds is fixed a wooden funnel *M*; whoſe lower end communicates with a fire-barrel (B), by which the flame paſſing through the funnel is conducted to the ſhrouds. Between the funnels, which are likewiſe called *fire-trunks*, are two ſcuttles, or ſmall holes, in the upper deck, ſerving alſo to let out the flames. Both funnels muſt be ſtopped with plugs, and have ſailcloth or canvas nailed cloſe over them, to prevent any accident happening from above to the combuſtibles laid below. *Falconer's Marine Dictionary*

The ports, funnels, and ſcuttles, not only communicate the flames to the outſide and upper works of the ſhip and her rigging; but likewiſe open a paſſage for the inward air, confined in the fire-room, which is thereby expanded ſo as to force impetuouſly through thoſe outlets, and prevent the blowing up of the decks, which muſt of neceſſity happen from ſuch a ſudden and violent rarefaction of the air as will then be produced.

On each ſide of the bulk-head behind is cut a hole, *L*, of ſufficient ſize to admit a trough of the ſame dimenſions as the others. A leading trough, *LI*, whoſe foremoſt end communicates with another trough within the fire-room, is laid cloſe to this opening, from whence it extends obliquely to a ſally-port, *I*, cut through the ſhip's ſide. The decks and troughs are well covered with melted roſin. At the time of the

(A) The iron chambers are 10 inches long and 3.5 in diameter. They are breeched againſt a piece of wood fixed acroſs the ports, and let into another a little higher. When loaded, they are almoſt filled with corn-powder, and have a wooden tompion well driven into their muzzles. They are primed with a ſmall piece of quick-match thruſt through their vents into the powder, with a part of it hanging out. When the ports are blown open by means of the iron chambers, the port-lids either fall downward, or are carried away by the exploſion.

(B) The fire-barrels ought to be of a cylindrical form, as moſt ſuitable to contain the reeds with which they are filled, and more convenient for ſtowing them between the troughs in the fire-room. Their inſide chambers ſhould not be leſs than 21 inches, and 30 inches is ſufficient for their length. The bottom parts are firſt well ſtored with ſhort double-dipped reeds placed upright; and the remaining vacancy is filled with fire-barrel compoſition well mixed and melted, and then poured over them. The compoſition uſed for this purpoſe is a maſs of ſulphur, pitch, tar, and tallow.

There are five holes, of three-fourths of an inch in diameter and three inches deep, formed in the top of the compoſition while it is yet warm; one being in the centre, and the other four at equal diſtances round the ſides of the barrel. When the compoſition is cold and hard, the barrel is primed by filling theſe holes with fuſe-compoſition, which is firmly driven into them, ſo as to leave a little vacancy at the top to admit a ſtrand of quick match twice doubled. The centre hole contains two ſtrands at their whole length, and every ſtrand muſt be driven home with mealed powder. The looſe ends of the quick match being then laid within the barrel, the whole is covered with a dipped curtain, faſtened on with a hoop that ſlips over the head of the barrel, to which it is nailed.

The barrels ſhould be made very ſtrong, not only to ſupport the weight of the compoſition before firing, when they are moved or carried from place to place, but to keep them together whilſt burning: for if the ſtaves are too light and thin, ſo as to burn very ſoon, the remaining compoſition will tumble out and be diſſipated, and the intention of the barrels, to carry the flame aloft, will accordingly be fruſtrated.

The curtain is a piece of coarſe canvas, nearly a yard in breadth and length, thickened with melted compoſition, and covered with ſaw-duſt on both ſides.

Fire. firing either of the leading troughs, the flame is immediately conveyed to the oppoſite ſide of the ſhip, whereby both ſides burn together.

The ſpaces *N*, *O*, behind the fire-room, repreſent the cabins of the lieutenant and maſter, one of which is on the ſtarboard, and the other on the larboard ſide. The captain's cabin, which is ſeparated from theſe by a bulk-head, is exhibited alſo by *P*.

Four of the eight fire-barrels are placed under the four fire-trunks; and the other four between them, two on each ſide the fire-ſcuttles, where they are ſecurely cleated to the deck. The longeſt reeds (c) are put into the fore and aft trough, and tied down: the ſhorteſt reeds are laid in the troughs athwart, and tied down alſo. The bavins (d), dipped at one end, are tied faſt to the troughs over the reeds, and the curtains are nailed up to the beams, in equal quantities, on each ſide of the fire-room.

The remainder of the reeds are placed in a poſition nearly upright, at all the angles of every ſquare in the fire-room, and there tied down. If any reeds are left, they are to be put round the fire-barrels, and other vacant places, and there tied faſt.

Inſtructions to Prime.

Take up all your reeds, one after another, and ſtrew a little compoſition at the bottom of all the troughs under the reeds, and then tie them gently down again: next ſtrew compoſition upon the upper part of the reeds throughout the fire-room; and upon the ſaid compoſition lay double quick match upon all the reeds, in all the troughs: the remainder of the compoſition ſtrew over all the fire-room, and then lay your bavins looſe.

Caſt off all the covers of the fire-barrels, and hang the quick match looſe over their ſides, and place leaders of quick match from the reeds into the barrels, and from thence into the vent of the chambers, in ſuch a manner as to be certain of their blowing open the ports, and ſetting fire to the barrels. Two troughs of communication from each door of the fire-room to the ſally ports, muſt be laid with a ſtrong leader of quick-match, four or five times double: alſo a croſs-piece to go from the ſally-port, when the ſhip is fired, to the communication trough, laid with leaders of quick-match, that the fire may be communicated in both ſides at once.

What quick-match is left place ſo that the fire may be communicated to all parts of the room at once, eſpecially about the ports and fire-barrels, and ſee that the chambers are well and freſh primed. [N. B. The port-fire uſed for firing the ſhip, burns about 12 minutes. Great care muſt be taken to have no powder on board when the ſhip is fired.] Fire.

The ſheer hooks (repreſented by *A*) are fitted ſo as to faſten on the yard-arms of the fire-ſhip, where they hook the enemy's rigging. The fire-grapplings (*B*) are either fixed on the yard-arms, or thrown by hand, having a chain to confine the ſhips together, or faſten thoſe inſtruments wherever neceſſary.

When the commanding officer of a fleet diſplays the ſignal to prepare for action, the fire-ſhips fix their ſheer hooks, and diſpoſe their grapplings in readineſs. The battle being begun, they proceed immediately to prime, and prepare their fire-works. When they are ready for grappling, they inform the admiral thereof by a particular ſignal.

To avoid being diſabled by the enemy's cannon during a general engagement, the fire-ſhips continue ſufficiently diſtant from their line of battle, either to windward or to leeward.

They cautiouſly ſhun the openings or intervals of the line, where they would be directly expoſed to the enemy's fire, from which they are covered by lying on the oppoſite ſide of their own ſhips. They are attentively to obſerve the ſignals of the admiral or his ſeconds, in order to put their deſigns immediately in execution.

Although no ſhip of the line ſhould be previouſly appointed to protect any fire-ſhip, except a few of the ſmalleſt particularly deſtined to this ſervice, yet the ſhip before whom ſhe paſſes in order to approach the enemy, ſhould eſcort her thither, and aſſiſt her with an armed boat, or whatever ſuccour may be neceſſary in her ſituation.

The captain of the fire-ſhip ſhould himſelf be particularly attentive that the above inſtructions are punctually executed, and that the yards may be ſo braced when he falls alongſide of the ſhip intended to be deſtroyed, that the ſheer-hooks and grapplings faſtened to the yard-arms, &c. may effectually hook the enemy. He is expected to be the laſt perſon who quits the veſſel; and being furniſhed with every neceſſary aſſiſtance and ſupport, his reputation will greatly depend on the ſucceſs of his enterpriſe.

Lambent Fires, as the ſhining of meat at certain ſeaſons, the luminouſneſs of the ſea, of inſects, vapours, &c. See Light, Chemistry *Index*; *Fire-Flies*, Entomology *Index*; *Glow-Worm*, &c.

Port-Fire. See *Port-Fire*.

Spur-Fire. See *Spur-Fire*.

Fire-Works, are preparations made of gunpowder, ſulphur,

(c) The reeds are made up in ſmall bundles of about a foot in circumference, cut even at both ends, and tied together in two places. They are diſtinguiſhed into two kinds, viz. the long and ſhort; the former of which are four feet, and the latter two feet five inches in length. One part of them are ſingly dipped, i. e. at one end; the reſt are dipped at both ends in a kettle of melted compoſition. After being immerſed about ſeven or eight inches in this preparation, and then drained, they are ſprinkled over with pulverized ſulphur upon a tanned hide.

(d) The bavins are made of birch, heath, or other bruſh-wood, which is tough and readily kindled. They are uſually two or three feet in length, and have all their buſh-ends lying one way, the other ends being tied together with ſmall cords. They are dipped in compoſition at the buſh-ends, whoſe branches are afterwards confined by the hand, to prevent them from breaking off by moving about; and alſo to make them burn more fercely. After being dipped in the ſame manner as the reeds, they alſo are ſprinkled with ſulphur.

Firing. sulphur, and other inflammable and combuſtible ingredients, uſed on occaſion of public rejoicings and other ſolemnities.

The invention of fire-works is by M. Mahudel attributed to the Florentines and people of Sienna; who found out likewiſe the method of adding decorations to them of ſtatues, with fire iſſuing from their eyes and mouths.

The art of preparing and managing theſe is called *pyrotechny*. See PYROTECHNY.

FIRING, in the military art, denotes the diſcharge of the fire-arms; and its object is to do the utmoſt execution to the enemy.

The method of firing by platoons is ſaid to have been invented by Guſtavus Adolphus, and firſt uſed about the year 1618; the reaſon commonly given for this method is, that a conſtant fire may be always kept up. There are three different ways of platoon firing; viz. ſtanding, advancing, and retreating. But previous to every kind of firing, each regiment or battalion muſt be told off in grand diviſions, ſubdiviſions, and platoons, excluſively of the grenadiers, which form two ſubdiviſions or four platoons of themſelves. In firing ſtanding, either by diviſions or platoons, the firſt fire is from the diviſion or platoon on the right; the ſecond fire from the left; the third from the right again; and ſo on alternately, till the firing comes to the centre platoon, which is generally called the *colour platoon*, and does not fire, remaining as a reſerve for the colours. Firing advancing is performed in the ſame manner, with this addition, that before either diviſion or platoon fires, it advances three paces forward. Firing retreating varies from either of the former methods; for before either diviſion or platoon fires, if they are marching from the enemy, it muſt go to the right about, and after firing, to the left about again, and continue the retreat as ſlow and orderly as poſſible.

In hedge firing the men are drawn up two deep, and in that order both ranks are to fire ſtanding. Oblique firing is either to the right and left, or from the right and left to the centre, according to the ſituation of the object. The Pruſſians have a particular contrivance for this purpoſe; if they are to level to the right, the rear ranks of every platoon make two quick but ſmall paces to the left, and the body of each ſoldier turns one-eighth of a circle, and *vice verſa*. Parapet firing depends on the nature of the parapet over which the men are to fire, and alſo upon that of the attack made to poſſeſs it. This method of firing is ſometimes performed by ſingle ranks ſtepping on the banquette and firing; each man inſtantly handing his arms to the centre rank of the ſame file, and taking his back in the room of it; and the centre rank giving it to the rear to load, and forwarding the arms of the rear to the front rank; by which means the front rank men can fire ſix or ſeven rounds in a minute with exactneſs. Parapet firing may alſo be executed two deep, when the banquette is three feet broad, or in field works where no banquettes are made. Square firing is performed by a regiment or body of men drawn up in a hollow ſquare, in which caſe each front is generally divided into four diviſions or firings, and the flanks of the ſquare, being the weakeſt part, are covered by four platoons of grenadiers. The firſt fire is from the right diviſion of each face; the ſecond from the left diviſion of each face, &c. and the grenadiers make the laſt fire. Street firing is practiſed in two ways; either by making the diviſion or platoon that has fired to wheel by half-rank to the right and left outwards from the centre, and to march in that order by half diviſions down the flanks on each ſide of the column, and to draw up in the rear, and go on with their priming and loading; or, to make the diviſion or platoon, after firing, to face to the right and left outwards from the centre, and one half rank to follow the other; and in that order to march in one centre file down on each ſide of the column into the rear, and there draw up as before. Firing || Firmicus.

FIRING Iron, in *Farriery*, an inſtrument not unlike the blade of a knife; which being made red hot is applied to a horſe's hams, or other places ſtanding in need of it, as in preternatural ſwellings, farcy, knots, &c. in order to diſcuſs them.

FIRKIN, an Engliſh meaſure of capacity for things liquid, being the fourth part of the barrel: it contains eight gallons of ale, ſoap, or herrings; and nine gallons of beer.

FIRLOT, a dry meaſure uſed in Scotland. The oat firlot contains 21¼th pints of that country; the wheat firlot contains about 2211 cubical inches; and the barley firlot, 31 ſtandard pints. Hence it appears that the Scotch wheat firlot exceeds the Engliſh buſhel by 33 cubical inches.

FIRMAMENT, in the ancient aſtronomy, the eighth heaven or ſphere; being that wherein the fixed ſtars were ſuppoſed to be placed. It is called the *eighth*, with reſpect to the ſeven heavens or ſpheres of the planets which it ſurrounds.

It is ſuppoſed to have two motions; a diurnal motion, given it by the *primum mobile*, from eaſt to weſt, about the poles of the ecliptic; and another oppoſite motion from weſt to eaſt; which laſt it finiſhes, according to Tycho, in 25,412 years; according to Ptolemy, in 36,000; and according to Copernicus, in 258,000; in which time the fixed ſtars return to the ſame preciſe points wherein they were at the beginning. This period is commonly called Plato's year, or the great year.

In various places of Scripture the word *firmament* is uſed for the middle region of the air. Many of the ancients allowed, with the moderns, that the firmament is a fluid matter; though they, who gave it the denomination of *firmament*, muſt have taken it for a ſolid one.

FIRMAN, is a paſſport or permit granted by the Great Mogul to foreign veſſels, to trade within the territories of his juriſdiction.

FIRMICUS, MATERNUS JULIUS, an eccleſiaſtical writer, who lived about the middle of the fourth century. Nothing is known with certainty reſpecting his country, profeſſion, or character, as we find no mention made of him in the writings of ancient authors. Some ſay that he was by birth a Sicilian, and practiſed in the forum as a barriſter for ſome time, becoming a convert to Chriſtianity when far advanced in years; which appears to derive conſiderable ſupport from different paſſages in his writings. He was author of a treatiſe *De errore profanarum religionum*, which was dedicated to the emperors Conſtantius and Conſtans. This work muſt

Firmneſs || First Fruits.

must have been written between 340 and 350, in which Conſtans was ſlain by Magnentius. It is allowed to be a learned, able, and well written performance, in which the reaſonableneſs of the Chriſtian religion is ſtrongly contraſted with the abſurdity and immorality of the gentile creed. It muſt not be diſſembled, however, that he ſometimes betrays ſuch a ſpirit of intolerance as is wholly incompatible with the genius of the Chriſtian religion, which breathes nothing but benevolence towards the whole human race. The arguments employed by him in its defence are diſgraced by an exhortation to the civil power to propagate it by force of arms, and to cruſh the advocates of error by ſevere edicts. This work was firſt publiſhed at Straſburg in 1562, at Heidelberg in 1559, and at Paris in 1610.

The greater part of critics aſcribe to him a work entitled *Aſtronomicorum, ſeu de Matheſi*, lib. viii. In it he treats of the power and influence of the ſtars, agreeably to the doctrine of the Egyptians and Babylonians, blending a conſiderable degree of mathematical knowledge with the unmeaning jargon of judicial aſtrology. Thoſe who imagine that ſo good a man as Firmicus could not have been the author of ſuch an abſurd performance, ſhould remember that it was probably compoſed prior to his converſion, when ſuch abſurdities would conſtitute a part of his creed.

FIRMNESS, denotes the conſiſtence of a body, or that ſtate wherein its ſenſible parts cohere in ſuch a manner, that the motion of one part induces a motion in the reſt.

FIRST-BORN. See PRIMOGENITURE, for the literal meaning of the term.

In Scripture it is alſo uſed often in a figurative ſenſe for that which is firſt, moſt excellent, moſt diſtinguiſhed in any thing. Thus it is ſaid of Chriſt (Col. i. 5.), that he is "the firſt-born of every creature;" and in Revelation (i. 5.) he is called "the firſt-begotten of the dead;" that is, according to the commentators, begotten of the Father before any creature was produced; and the firſt who roſe from the dead by his own power. "The firſt-born of the poor," (Iſa. xiv. 30.) ſignifies, The moſt miſerable of all the poor; and in Job (xviii. 13.) The firſt-born of death;" that is, The moſt terrible of all deaths.

First Fruits (*primitiæ*), among the Hebrews, were oblations of part of the fruits of the harveſt, offered to God as an acknowledgment of his ſovereign dominion. The firſt of theſe fruits was offered in the name of the whole nation, being either two loaves of bread, or a ſheaf of barley which was thraſhed in the court of the temple. Every private perſon was obliged to bring his firſt fruits to the temple; and theſe conſiſted of wheat, barley, grapes, figs, apricots, olives, and dates.

There was another ſort of firſt fruits which were paid to God. When bread was kneaded in a family, a portion of it was ſet apart and given to the prieſt or Levite who dwelt in the place; if there was no prieſt or Levite there, it was caſt into the oven, and conſumed by the fire. Theſe offerings made a conſiderable part of the revenues of the Hebrew prieſthood.

Firſt Fruits are frequently mentioned in ancient Chriſtian writers as one part of the church revenue. One of the councils of Carthage enjoins, that they ſhould conſiſt only of grapes and corn; which ſhows, that this was the practice of the African church.

Fiſc || Fiſh.

First Fruits, in the church of England, are the profits of every ſpiritual benefice for the firſt year, according to the valuation thereof in the king's books.

FISC, (*Fiſcus*), in the *Civil Law*, the treaſury of a prince or ſtate; or that to which all things due to the public do fall. The word is derived from the Greek φισκος, "a great baſket," uſed when they went to market.—By the civil law, none but a ſovereign prince has a right to have a fiſc or public treaſury.

At Rome, under the emperors, the term *ærarium* was uſed for the revenues deſtined for ſupport of the charges of the empire; the *fiſcus* for thoſe of the emperor's own family. The treaſury, in effect, belonged to the people, and the fiſcus to the prince. Hence the goods of condemned perſons, if appropriated to the uſe of the public, were ſaid *publicari*; if to the ſupport of the emperor or prince, *confiſcari*.

FISCAL, in the *Civil Law*, ſomething relating to the pecuniary intereſt of the prince or people. The officers appointed for the management of the fiſc, were called *procuratores fiſci*, and *advocati fiſci*; and among the caſes enumerated in the conſtitutions of the empire where it was their buſineſs to plead, one is againſt thoſe who have been condemned to pay a fine to the fiſc on account of their litigiouſneſs or frivolous appeals.

FISCUS. See FISC.

FISH, in *Natural Hiſtory*, an animal that lives in the waters as the natural place of its abode.

Fiſhes form the fourth claſs of animals in the Linnæan ſyſtem. Their moſt general or popular diviſion is into *freſh* and *ſalt* water ones. Some, however, are of opinion, that all fiſhes naturally inhabit the ſalt waters, and that they have mounted up into rivers only by accident. A few ſpecies only ſwim up into the rivers to depoſit their ſpawn; but by far the greateſt number keep in the ſea, and would ſoon expire in freſh water. There are about 400 ſpecies of fiſhes (according to Linnæus) of which we know ſomething: but the unknown ones are ſuppoſed to be many more; and as they are thought to lie in great depths of the ſea remote from land, it is probable that many ſpecies will remain for ever unknown.

For the ſubdiviſions, characters, and natural hiſtory of this claſs of animals, ſee ICHTHYOLOGY *Index*.

Blowing of FISH, is a practice ſimilar to that of blowing fleſh, poultry, and pigs, and adopted for the ſame deceitful purpoſes. The method of blowing fiſh, eſpecially cod and whitings, is by placing the end of a quill or tobacco-pipe at the vent, and pricking a hole with a pin under the fin which is next the gill; thereby making the fiſh appear to the eye large and full, which when dreſſed will be flabby, and little elſe than ſkin and bones. But this impoſition may be diſcovered by placing the finger and thumb on each ſide of the vent, and ſqueezing it hard; the wind may be perceived to go out, the ſkin will fall in, and the fiſh appear lank, and of little value.

Breeding of FISHES may be turned to great advantage; for, beſides furniſhing the table, obliging one's friends, and raiſing money, the land will be thereby greatly

Fiſh. greatly improved, ſo as to yield more this way than by any other employment whatever. See *Fish Pond.*

Caſtration of Fish, is a method firſt practiſed by Mr Tull, in order to prevent the exceſſive increaſe of fiſh in ſome of his ponds, where the numbers did not permit any of them to grow to an advantageous ſize. But he afterwards found, that the caſtrated fiſh grew much larger than their uſual ſize, were more fat, and always in ſeaſon. This operation may be performed both on male and female fiſh; and the moſt eligible time for it is when the ovaries of the female have their ova in them, and when the veſſels of the male, analogous to theſe, have their ſeminal matter in them; becauſe, at this time, theſe veſſels are more eaſily diſtinguiſhed from the ureters, which convey the urine from the kidneys into the bladder, and are ſituated near the ſeminal veſſels on each ſide of the ſpine; which, without ſufficient attention, may be miſtaken for the ovaries, eſpecially when theſe laſt are empty. The time leaſt proper for this operation, is juſt after they have ſpawned, becauſe the fiſh are then too weak and languid to bear, with ſucceſs, ſo ſevere an operation; however, with ſkill and care, it may be performed almoſt at any time. When a fiſh is to be caſtrated, it muſt be held in a wet cloth, with its belly upwards; then with a ſharp pen-knife, having its point bent backwards, the operator cuts through the integuments of the rim of the belly, taking care not to wound any of the inteſtines. As ſoon as a ſmall aperture is made, he carefully inſerts a hooked pen-knife, and with this dilates the aperture from between the two fore-fins almoſt to the anus. He then, with two ſmall blunt ſilver hooks, five or ſix inches long, and of this form P, by the help of an aſſiſtant, holds open the belly of the fiſh; and with a ſpoon or ſpatula, removes carefully the inteſtines from one ſide. When theſe are removed, you ſee the ureter; a ſmall veſſel, nearly in the direction of the ſpine, and alſo the ovary, a larger veſſel, lying before it, nearer the integuments of the belly. This laſt veſſel is taken up with a hook of the ſame kind with thoſe before mentioned, and, after detaching it from the ſide far enough for the purpoſe, divided tranſverſely with a pair of ſharp ſciſſars, care being taken that the inteſtines are not wounded or injured. After one of the ovaries has been divided, the operator proceeds to divide the other in the ſame manner; and then the divided integuments of the belly are ſewed with ſilk, the ſtitches being inſerted at a ſmall diſtance from one another. Mr Tull obſerves farther, that the ſpawning time is very various; that trouts are full about Chriſtmas; perch in February; pikes in March, and carp and tench in May; and that allowance muſt be made for climate and ſituation, with regard to the ſpawning of fiſh. When the fiſh are caſtrated, they are put into the water where they are intended to continue; and they take their chance in common with other fiſh, as though they were not caſtrated. With tolerable care, few die of the operation. *Phil. Tranſ.* vol. xlviii. Part 2. Art. 106.

Although we could not properly avoid inſerting the above detail, it is preſumed that few will be pleaſed with the invention. The operation is peculiarly cruel, and the purpoſe of it only a deteſtable piece of Apician refinement.

Feeding of Fishes. When they are fed in large pools or ponds, either malt boiled, or freſh grains, is the beſt food; thus carps may be raiſed and fed like capons, and tenches will feed as well. The care of feeding them is beſt committed to a gardener or the butler, who ſhould be always at hand. When fed in a ſtew, any ſort of grain boiled, eſpecially peas, and malt coarſely ground, are proper food; alſo the grains after brewing, while freſh and ſweet; but one buſhel of malt not brewed will go as far as two of grains. Fiſh.

Stealing of Fish, by perſons armed and diſguiſed, is felony without benefit of clergy, by 9 Geo. I. cap. 22. See *Black Act.* And by 5 Geo. III. cap. 14. the penalty of tranſportation for ſeven years is inflicted on perſons ſtealing or taking fiſh in any water, within a park, paddock, orchard, or yard; and on the receivers, aiders, and abettors; and a forfeiture of five pounds to the owner of the fiſhery is made payable by perſons taking or deſtroying (or attempting ſo to do) any fiſh in any river or other water within any incloſed ground, being private property.

Preſerving of Fish for Cabinets. Linnæus's method is, to expoſe them to the air; and when they acquire ſuch a degree of putrefaction that the ſkin loſes its coheſion to the body of the fiſh, it may be ſlid off almoſt like a glove; the two ſides of this ſkin may then be dried upon paper like a plant, or one of the ſides may be filled with plaiſter of Paris to give the ſubject a due plumpneſs. *Amæn. Acad.* tom iii.

A fiſh may be prepared, after it has acquired this degree of putrefaction, by making a longitudinal inciſion on the belly, and carefully diſſecting the fleſhy part from the ſkin, which is but ſlightly attached to it in conſequence of the putreſcency. The ſkin is then to be filled with cotton and the antiſeptic powder as directed for birds; and, laſtly, to be ſewed up where the inciſion was made.

Gold Fish. See Cyprinus, Ichthyology *Index.*

Gilding on Fish. In the poſthumous papers of Mr Hooke, a method is deſcribed of gilding live craw fiſh, carps, &c. without injuring the fiſh. The cement for this purpoſe is prepared, by putting ſome burgundy pitch into a new earthen pot, and warming the veſſel till it receives ſo much of the pitch as will ſtick round it; then ſtrewing ſome finely powdered amber before the pitch when growing cold, adding a mixture of three pounds of linſeed oil and one of oil of turpentine, covering the veſſel, and boiling them for an hour over a gentle fire, and grinding the mixture, as it is wanted, with ſo much pumice-ſtone in fine powder as will reduce it to the conſiſtence of paint. The fiſh being wiped dry, the mixture is ſpread upon it; and the gold-leaf being then laid on, and gently preſſed down, the fiſh may be immediately put into water again, without any danger of the gold coming off, for the matter quickly grows firm in water.

Fish, in a ſhip, a plank or piece of timber, faſtened to a ſhip's maſt or yard, to ſtrengthen it; which is done by nailing it on with iron ſpikes, and winding ropes hard about them.

Fishes, in *Heraldry*, are the emblems of ſilence and watchfulneſs; and are borne either upright, imbowed, extended, endorſed reſpecting each other, ſurmounting one another, fretted, &c.

In blazoning fiſhes, thoſe borne feeding, ſhould be termed *devouring*; all fiſhes borne upright and having fins,

Fiſher. fins, ſhould be blazoned *hauriant;* and thoſe borne tranſverſe the eſcutcheon, muſt be termed *naiant*.

Fish Ponds, thoſe made for the breeding or feeding of fiſh.

Fiſh ponds are no ſmall improvement of watery and boggy lands, many of which are fit for no other uſe. In making of a pond, its head ſhould be at the loweſt part of the ground, that the trench of the flood-gate or ſluice, having a good fall, may not be too long in emptying. The beſt way of making the head ſecure, is to drive in two or three rows of ſtakes above ſix feet long, at above four feet diſtance from each other, the whole length of the pond head, whereof the firſt row ſhould be rammed at leaſt about four feet deep. If the bottom is falſe, the foundation may be laid with quicklime; which ſlaking, will make it as hard as a ſtone. Some lay a layer of lime, and another of earth dug out of the pond, among the piles and ſtakes; and when theſe are well covered, drive in others as they ſee occaſion, ramming in the earth as before, till the pond head be of the height deſigned.

The dam ſhould be made ſloping on each ſide, leaving a waſte to carry off the over abundance of water in times of floods or rains; and as to the depth of the pond, the deepeſt part need not exceed ſix feet, riſing gradually in ſhoals towards the ſides, for the fiſh to ſun themſelves, and lay their ſpawn. Gravelly and ſandy bottoms, eſpecially the latter, are beſt for breeding; and a fat ſoil with a white fat water, as the waſhings of hills, commons, ſtreets, ſinks, &c. is beſt for fattening all ſorts of fiſh. For ſtoring a pond, carp is to be preferred for its goodneſs, quick growth, and great increaſe, as breeding five or ſix times a-year. A pond of an acre, if it be a feeding and not breeding one, will every year feed 200 carps of three years old, 300 of two years old, and 400 of a year old. Carps delight in ponds that have marl or clay bottoms, with plenty of weeds and graſs, whereon they feed in the hot months.

Ponds ſhould be drained every three or four years, and the fiſh ſorted. In breeding ones, the ſmaller ones are to be taken out, to ſtore other ponds with; leaving a good ſtock of females, at leaſt eight or nine years old, as they never breed before that age. In feeding ponds, it is beſt to keep them pretty near of a ſize.

FISHER, John, biſhop of Rocheſter, was born at Beverly in Yorkſhire, in the year 1459, and educated in the collegiate church of that place. In 1484, he removed to Michael houſe in Cambridge, of which college he was elected maſter in the year 1495. Having applied himſelf to the ſtudy of divinity, he took orders; and, becoming eminent as a divine, attracted the notice of Margaret counteſs of Richmond, mother of Henry VII. who made him her chaplain and confeſſor. In 1501, he took the degree of doctor of divinity, and the ſame year was elected chancellor of the univerſity. In the year following, he was appointed Lady Margaret's firſt divinity profeſſor; and in 1504, conſecrated biſhop of Rocheſter; which ſmall biſhopric he would never reſign, though he was offered both Ely and Lincoln. It is generally allowed, that the foundation of the two colleges of Chriſt church and St John's, in Cambridge, was entirely owing to Biſhop Fiſher's perſuaſion and influence with the counteſs of Richmond: he not only formed the deſign, but ſuperintended the execution. On the promulgation of Martin Luther's doctrine, our biſhop was the firſt to enter the liſts againſt him. On this occaſion he exerted all his influence, and is generally ſuppoſed to have written the famous book by which Henry VIII. obtained the title of *Defender of the Faith*. Hitherto he continued in favour with the king; but in 1527, oppoſing his divorce, and denying his ſupremacy, the implacable Harry determined, and finally effected, his deſtruction. In 1543, the parliament found him guilty of miſpriſion of treaſon, for concealing certain prophetic ſpeeches of a fanatical impoſtor, called the *Holy Maid of Kent*, relative to the king's death; and condemned him, with five others, in loſs of goods, and impriſonment during his majeſty's pleaſure; but he was releaſed on paying 300l. for the king's uſe. Fiſher. Fiſhery.

King Henry being now married to Anne Boleyn, his obſequious parliament took an oath of allegiance proper for the occaſion. This oath the biſhop of Rocheſter ſteadily refuſed; alleging, that his conſcience could not be convinced that the king's firſt marriage was againſt the law of God. For refuſing this oath of ſucceſſion, he was attainted by the parliament of 1534; and committed to the Tower, where he was cruelly treated, and were he would probably have died a natural death, had not the pope created him a cardinal. The king, now poſitively determined on his deſtruction, ſent Rich, the ſolicitor general, under the pretence of conſulting the biſhop on a caſe of conſcience, but really with a deſign to draw him into a converſation concerning the ſupremacy. The honeſt old biſhop ſpoke his mind without ſuſpicion or reſerve, and an indictment and conviction of high treaſon was the conſequence. He was beheaded at Tower Hill, on the 22d of June 1535, in the 77th year of his age. Thus died this good old prelate; who, notwithſtanding his inflexible enmity to the Reformation, was undoubtedly a learned, pious, and honeſt man. He wrote ſeveral treatiſes againſt Luther, and other works, which were printed at Wurtzburg, in 1597, in one volume folio.

FISHERY, a place where great numbers of fiſh are caught.

The principal fiſheries for ſalmon, herring, mackrel, pilchards, &c. are along the coaſts of Scotland, England, and Ireland: for cod, on the banks of Newfoundland: for whales, about Greenland; and for pearls, in the Eaſt and Weſt Indies.

Free Fishery, in *Law*, or an excluſive right of fiſhing in a public river, is a royal franchiſe; and is conſidered as ſuch in all countries where the feodal polity has prevailed: though the making ſuch grants, and by that means appropriating, what it ſeems unnatural to reſtrain, the uſe of running water, was prohibited for the future by King John's Great Charter; and the rivers that were fenced in his time were directed to be laid open, as well as the foreſts to be diſforeſted. This opening was extended by the ſecond and third charters of Henry III. to thoſe alſo that were fenced under Richard I.; ſo that a franchiſe of free fiſhery ought now to be as old at leaſt as the reign of Henry II. This differs from a *ſeveral of piſcary*, becauſe he that has a ſeveral fiſhery muſt alſo be the owner of the ſoil, which in a free fiſhery is not requiſite. It differs alſo from a *common* fiſhery in that the free fiſhery is an excluſive right, *Blackſtone's Comment.*

Fishery. right, the common fishery is not so: and therefore, in a free fishery, a man has property in the fish before they are caught; in a common piscary, not till afterwards. Some indeed have considered a *free* fishery not as a royal franchise; but merely as a private grant of a liberty to fish in the *several* fishery of the grant. But the considering such right as originally a flower of the prerogative, till restrained by Magna Charta, and derived by royal grant (previous to the reign of Richard I.) to such as now claim it by prescription, may remove some difficulties in respect to this matter with which our law books are embarrassed.

FISHERY, denotes also the commerce of fish, more particularly the catching them for sale.

Were we to enter into a very minute and particular consideration of fisheries, as at present established in this kingdom, this article would swell beyond its proper bounds; because, to do justice to a subject of such concernment to the British nation, requires a very ample and distinct discussion. We shall, however, observe, that since the Divine Providence hath so eminently stored the coasts of Great Britain and Ireland with the most valuable fish; and since fisheries, if successful, become permanent nurseries for breeding expert seamen; it is not only a duty we owe to the Supreme Being, not to despise the wonderful plenty he hath afforded us, by neglecting to extend this branch of commerce to the utmost; but it is a duty we owe to our country, for its natural security, which depends upon the strength of our royal navy. No nation can have a navy where there is not a fund of business to breed and employ seamen without any expence to the public, and no trade is so well calculated for training up these useful members of society as fisheries.

The situation of the British coasts is the most advantageous in the world for catching fish: the Scottish islands, particularly those to the north and west, lie most commodious for carrying on the fishing trade to perfection; for no country in Europe can pretend to come up to Scotland in the abundance of the finest fish, with which its various creeks, bays, rivers, lakes, and coasts, are replenished. Of these advantages the Scots seem indeed to have been abundantly sensible; and their traffic in herrings, the most valuable of all the fisheries, is noticed in history so early as the ninth century. The frequent laws which were enacted in the reigns of James III. IV. and V. discover a steady determined zeal for the benefit of the native subjects, and the full restoration of the fisheries, which the Dutch had latterly found means to engross; and do honour to the memory of those patriots whom modern times affect to call barbarians.

The expedition of James V. to the Hebrides and western parts of the Highlands and his assiduity in exploring and sounding the harbours, discovered a fixed resolution in that active prince, to civilize the inhabitants, to promote the valuable fisheries at their doors, and to introduce general industry. His death, at an early period, and the subsequent religious and civil commotions in the kingdom, frustrated those wise designs, and the western fisheries remained in their original state of neglect. At length, 1602, James VI. resumed the national purposes which had been thus chalked out by his grandfather. "Three towns (says Dr Robertson) which might serve as a retreat for the industrious, and a nursery for arts and commerce, were appointed to be built in different parts of the Highlands; one in Cantire, another in Lochaber, and a third in the isle of Lewis; and in order to draw the inhabitants thither, all the privileges of the royal boroughs were to be conferred upon them. Finding it, however, to be no easy matter to inspire the inhabitants of those countries with the love of industry, a resolution was taken to plant amongst them colonies of people from the more industrious counties. The first experiment was made in the isle of Lewis; and as it was advantageously situated for the fishing trade (a source from which Scotland ought naturally to derive great wealth), the colony transported thither was drawn out of Fife, the inhabitants of which were well skilled in that branch of commerce. But before they had remained there long enough to manifest the good effects of this institution, the islanders, enraged at seeing their country occupied by those intruders, took arms, and surprising them in the night time, murdered some of them, and compelled the rest to abandon the settlement. The king's attention being soon turned to other objects, particularly to his succession to the English crown, we hear no more of this salutary project." Fishery.

The Scottish fisheries were, however, resumed by Charles I. who "ordained an association of the three kingdoms, for a general fishing within the hail seas and coasts of his majesty's said kingdoms; and for the government of the said association, ordained, that there should be a standing committee chosen and nominated by his majesty, and his successors from time to time." &c. &c. Several persons of distinction embarked in the design, which the king honoured with his patronage, and encouraged by his bounty. He also ordered lent to be more strictly observed; prohibited the importation of fish taken by foreigners; and agreed to purchase from the company his naval stores and the fish for his fleets. Thus the scheme of establishing a fishery in the Hebrides began to assume a favourable aspect; but all the hopes of the adventurers were frustrated by the breaking out of the civil wars, and the very tragical death of their benefactor.

In 1661, Charles II. the duke of York, Lord Clarendon, and other persons of rank and fortune, resumed the business of the fisheries with greater vigour than any of their predecessors. For this purpose the most salutary laws were enacted by the parliaments of England and Scotland; in virtue of which, all materials used in, or depending upon, the fisheries, were exempted from all duties, excises, or imposts whatever. In England, the company were authorised to set up a lottery, and to have a voluntary collection in all parish churches; houses of entertainment, as taverns, inns, ale-houses, were to take one or more barrels of herrings, at the stated price of 30s. per barrel; and 2s. 6d. per barrel was to be paid to the stock of this company on all imported fish taken by foreigners. Some Dutch families were also invited, or permitted, to settle in Stornaway: the herrings cured by the Royal English company gave general satisfaction, and, as mentioned above, brought a high price for those days. Every circumstance attending this new establishment seemed to be the result of a judicious plan and thorough knowledge of the

Fiſhery. buſineſs, when the neceſſities of the king obliged him to withdraw his ſubſcription or bounty; which gave ſuch umbrage to the parties concerned, that they ſoon after diſſolved.

In 1677, a new royal company was eſtabliſhed in England, at the head of which was the duke of York, the earl of Derby, &c. Beſides all the privileges which former companies had enjoyed, the king granted this new company a perpetuity, with power to purchaſe lands; and alſo 20l. to be paid them annually, out of the cuſtoms of the port of London, for every dogger or buſs they ſhould build and ſend out for ſeven years to come. A ſtock of 10,980l. was immediately advanced, and afterwards 1600l. more. This ſmall capital was ſoon exhauſted in purchaſing and fitting out buſſes, with other incidental expences. The company, made, however, a ſucceſsful beginning; and one of their buſſes or doggers actually took and brought home 32,000 cod fiſh; other veſſels had alſo a favourable fiſhery. Such favourable beginnings might have excited freſh ſubſcriptions, when an unforeſeen event ruined the whole deſign beyond the poſſibility of recovery. Moſt of the buſſes had been built in Holland, and manned with Dutchmen; on which pretence the French, who were then at war with Holland, ſeized ſix out of ſeven veſſels, with their cargoes and fiſhing tackle: and the company being now in debt, ſold, in 1680, the remaining ſtores, &c. A number of gentlemen and merchants raiſed a new ſubſcription of 60,000l. under the privileges and immunities of the former charter. This attempt alſo came to nothing, owing to the death of the king, and the troubles of the ſubſequent reign.

Soon after the Revolution this buſineſs was again reſumed, and upon a more extenſive ſcale; the propoſed capital being 300,000l. of which 100,000l. was to have been raiſed by the ſurviving patentees or their ſucceſſors, and 200,000l. by new ſubſcribers. Copies of the letters patent, the conſtitution of the company, and terms of ſubſcription, were lodged at ſundry places in London and Weſtminiſter, for the peruſal of the public, while the ſubſcription was filling. It is probable, that King William's partiality to the Dutch fiſheries, the ſucceeding war, or both of theſe circumſtances, fruſtrated this new attempt; of which we have no farther account in the annals of that reign or ſince.

The Scottiſh parliament had alſo, during the three laſt reigns, paſſed ſundry acts for erecting companies and promoting the fiſheries; but the inteſtine commotions of that country, and the great exertions which were made for the Darien eſtabliſhment, enfeebled all other attempts, whether collectively or by individuals, within that kingdom.

In 1749, his late majeſty having, at the opening of the parliament, warmly recommended the improvement of the fiſheries, the houſe of commons appointed a committee to inquire into the ſtate of the herring and white fiſheries, and to conſider of the moſt probable means of extending the ſame. All ranks of men were elevated with an idea of the boundleſs riches that would flow into the kingdom from this ſource. A ſubſcription of 500,000l. was immediately filled in the city, by a body of men who were incorporated for 21 years by the name of *The Society of the Free Britiſh Fiſhery.* Every encouragement was held out by government, both to the ſociety, and to individuals who might embark in this national buſineſs. A bounty of 36s. per ton was to be paid annually out of the cuſtoms, for 14 years, to the owners of all decked veſſels or buſſes, from 20 to 80 tons burden, which ſhould be built after the commencement of the act, for the uſe of, and fitted out and employed in, the ſaid fiſheries, whether by the ſociety or any other perſons. At the ſame time numerous pamphlets and newſpaper eſſays came forth; all pretending to elucidate the ſubject, and to convince the public with what facility the herring fiſheries might be transferred from Dutch to Britiſh hands. This proved, however, a more arduous taſk than had been foreſeen by ſuperficial ſpeculators. The Dutch were frugal in their expenditures and living; perfect maſters of the arts of fiſhing and curing, which they had carried to the greateſt height and perfection. They were in full poſſeſſion of the European markets; and their fiſh, whether deſerving or otherwiſe, had the reputation of ſuperior qualities to all others taken in our ſeas. With ſuch advantages, the Dutch not only maintained their ground againſt this formidable company, but had alſo the pleaſure of ſeeing the capital gradually ſinking, without having procured an adequate return to the adventurers; notwithſtanding various aids and efforts of government from time to time in their favour, particularly in 1757, when an advance of 20s. per ton was added to the bounty. Fiſhery.

In 1786 the public attention was again called to the ſtate of the Britiſh fiſheries, by the ſuggeſtions of Mr Dempſter in the houſe of commons, and by different publications that appeared upon the ſubject: in conſequence of which the miniſter ſuffered a committee to be named, to inquire into this great ſource of national wealth. To that committee it appeared, that the beſt way of improving the fiſheries was to encourage the inhabitants living neareſt to the ſeat of them to become fiſhers: And it being found that the north-weſtern coaſt of the kingdom, though abounding with fiſh and with fine harbours, was utterly deſtitute of towns, an act was paſſed for incorporating certain perſons therein named, by the ſtyle of "*The Britiſh Society* for extending of the fiſheries and improving the ſea coaſts of the kingdom;" and to enable them to ſubſcribe a joint ſtock, and therewith to purchaſe lands, and build thereon free towns, villages, and fiſhing ſtations, in the Highlands and iſlands in that part of Great Britain called Scotland, and for other purpoſes. The iſle of Mull, Loch Broom, the iſles of Sky and of Cannay, have already been pitched upon as proper ſituations for ſome of theſe towns. The progreſs of ſuch an undertaking from its nature muſt be ſlow, but ſtill ſlower when carried on with a limited capital ariſing from the ſubſcriptions of a few public-ſpirited individuals. But it is not to be doubted but that it will ultimately tend to the increaſe of our fiſheries, and to the improvement of the Highland part of this kingdom. Its tendency is alſo to leſſen the emigration of a brave and induſtrious race of inhabitants, too many of whom have already removed with their families to America.

1. *Anchovy* FISHERY. The anchovy is caught in the months of May, June, and July, on the coaſts of Catalonia, Provence, &c. at which ſeaſon it conſtantly repairs up the ſtraits of Gibraltar, into the Mediterranean.

Collins

Fishery. Collins says they are also found in plenty on the western coasts of England and Wales.

The fishing for them is chiefly in the night time; when a light being put on the stern of their little fishing vessels, the anchovies flock round, and are caught in the nets. But then it is asserted to have been found by experience, that anchovies taken thus by fire, are neither so good, so firm, nor so proper for keeping, as those which are taken without fire.

When the fishery is over, they cut off the heads, take out their gall and guts, and then lay them in barrels, and salt them. The common way of eating anchovies is with oil, vinegar, &c. in order to which they are first boned, and the tails, fins, &c. slipped off.—Being put on the fire, they dissolve almost in any liquor. Or they are made into a sauce by minching them with pepper, &c. Some also pickle anchovies in small delft or earthen pots, made on purpose, of two or three pounds weight, more or less, which they cover with plaster to keep them the better. Anchovies should be chosen small, fresh pickled, white on the outside and red within. They must have a round back; for those which are flat or large are often nothing but sardines. Besides these qualities, the pickle, on opening the pots or barrels, must be of a good taste, and not have lost its flavour.

2. *Cod* Fishery. There are two kinds of cod fish; the one green or white cod, and the other dried or cured cod; though it is all the same fish, differently prepared; the former being sometimes salted and barrelled, then taken out for use; and the latter, having lain some competent time in salt, dried in the sun or smoke. We shall therefore speak of each of these apart; and first of the

Green. The chief fisheries for green cod are in the bay of Canada, on the great bank of Newfoundland, and on the isle of St Peter, and the isle of Sable; to which places vessels resort from divers parts both of Europe and America. They are from 100 to 150 tons burden, and will catch between 30,000 and 40,000 cod each. The most essential part of the fishery is, to have a master who knows how to cut up the cod, one who is skilled to take off the head properly, and above all a good salter, on which the preserving of them, and consequently the success of the voyage depends. The best season is from the beginning of February to the end of April; the fish, which in the winter retire to the deepest water, coming then on the banks, and fattening extremely. What is caught from March to June keeps well; but those taken in July, August, and September, when it is warm on the banks, are apt to spoil soon. Every fisher takes but one at a time: the most expert will take from 350 to 400 in a day; but that is the most, the weight of the fish and the great coldness on the bank fatiguing very much. As soon as the cod are caught, the head is taken off; they are opened, gutted, and salted; and the salter stows them in the bottom of the hold, head to tail, in beds a fathom or two square; laying layers of salt and fish alternately, but never mixing fish caught on different days. When they have lain thus three or four days to drain off the water, they are replaced in another part of the ship, and salted again; where they remain till the vessel is loaded. Sometimes they are cut in thick pieces, and put in barrels for the conveniency of carriage. Fishery.

Dry. The principal fishery for this article is, from Cape Rose to the Bay des Exports, along the coast of Placentia, in which compass there are divers commodious ports for the fish to be dried in. These, though of the same kind with the fresh cod, are much smaller, and therefore fitter to keep, as the salt penetrates more easily into them. The fishery of both is much alike; only this latter is most expensive, as it takes up more time and employs more hands, and yet scarce half so much salt is spent in this as in the other. The bait is herrings, of which great quantities are taken on the coast of Placentia. When several vessels meet and intend to fish in the same part, he whose shallop first touches ground becomes entitled to the quality and privileges of admiral: he has the choice of his station, and the refusal of all the wood on the coast at his arrival. As fast as the masters arrive, they unrigg all their vessels, leaving nothing but the shrouds to sustain the masts; and in the mean time the mates provide a tent on shore, covered with branches of trees, and sails over them, with a scaffold of great trunks of pines, 12, 15, 16, and often 20 feet high, commonly from 40 to 60 feet long, and about one-third as much in breadth. While the scaffold is preparing, the crew are a-fishing; and as fast as they catch, they bring their fish ashore, and open and salt them upon moveable benches; but the main salting is performed on the scaffold. When the fish have taken salt, they wash and hang them to drain on rails; when drained, they are laid on kinds of stages, which are small pieces of wood laid across, and covered with branches of trees, having the leaves stripped off for the passage of the air. On these stages, they are disposed, a fish thick, head against tail, with the back uppermost, and are turned carefully four times every 24 hours. When they begin to dry, they are laid in heaps 10 or 12 thick, in order to retain their warmth; and every day the heaps are enlarged till they become double their first bulk; then two heaps are joined together, which they turn every day as before: lastly, they are salted again, beginning with those first salted; and being laid in huge piles, they remain in that situation till they are carried on board the ships, where they are laid on the branches of trees disposed for that purpose, upon the ballast, and round the ship, with mats to prevent their contracting any moisture.

There are four sorts of commodities drawn from cod, viz. the sounds, the tongues, the roes, and the oil extracted from the liver. The first is salted at the fishery together with the fish, and put in barrels from 600 to 700 pounds. The tongues are done in like manner, and brought in barrels from 400 to 500 pounds. The roes are also salted in barrels, and serve to cast into the sea to draw fish together, and particularly pilchards. The oil comes in barrels, from 400 to 520 pounds, and is used in dressing leather. In Scotland, they catch a small kind of cod on the coasts of Buchan, and all along the Murray frith on both sides; as also in the friths of Forth, Clyde, &c. which is much esteemed. They salt and dry them in the sun upon rocks, and sometimes in the chimney.

3. *Coral* Fishery. See Coral.

Fiſhery. 4. *Herring* FISHERY. Our great ſtations for this fiſhery are off the Shetland and Weſtern iſles, and off the coaſt of Norfolk, in which the Dutch alſo ſhare. There are two ſeaſons for fiſhing herring; the firſt from June to the end of Auguſt; and the ſecond in autumn, when the fogs become very favourable for this kind of fiſhing. The Dutch begin their herring fiſhing on the 24th of June, and employ a vaſt number of veſſels therein, called *buſſes*, being between 45 and 60 tons burden each, and carrying three or four ſmall cannon. They never ſtir out of port, without a convoy, unleſs there be enough together to make about 18 or 20 cannon among them, in which caſe they are allowed to go in company. Before they go out they make a verbal agreement, which has the ſame force as if it were in writing. The regulations of the admiralty of Holland are partly followed by the French and other nations, and partly improved and augmented with new ones; as, that no fiſher ſhall caſt his net within 100 fathoms of another boat: that while the nets are caſt, a light ſhall be kept on the hind part of the veſſel: that when a boat is by any accident obliged to leave off fiſhing, the light ſhall be caſt into the ſea; that when the greater part of a fleet leaves off fiſhing, and caſts anchor, the reſt ſhall do the ſame, &c.

‡ *Hiſt. of Commerce.* Mr Anderſon ‡ gives to the Scots a knowledge of great antiquity in the herring fiſhery. He ſays that the Netherlanders reſorted to theſe coaſts as early as A. D. 836, to purchaſe ſalted fiſh of the natives, but, impoſing on the ſtrangers, they learned the art, and took up the trade, in after-times of ſuch immenſe emolument to the Dutch.

Sir Walter Raleigh's obſervations on that head, extracted from the ſame author, are extremely worthy the attention of the curious, and excite reflections on the vaſt ſtrength reſulting from the wiſdom of well applied induſtry.

In 1603, he remarks, the Dutch ſold to different nations as many herrings as amounted to 1,759,000l. ſterling. In the year 1615, they at once ſent out 2000 buſſes, and employed in them 37,000 fiſhermen. In the year 1618, they ſent out 3000 ſhips, with 50,000 men to take the herrings, and 9000 more ſhips to tranſport and ſell the fiſh; which by ſea and land employed 150,000 men, beſides thoſe firſt mentioned. All this wealth was gotten on our coaſts, while our attention was taken up in a diſtant whale fiſhery.

The Scottiſh monarchs for a long time ſeemed to direct all their attention to the preſervation of the ſalmon fiſhery, probably becauſe their ſubjects were ſuch novices in ſea affairs. At length James III. endeavoured to ſtimulate his great men to theſe patriotic undertakings: for by an act of his third parliament, he compelled "certain lords ſpiritual and temporal, and burrows, to make ſhips, buſſes, and boats, with nets and other pertinents, for fiſhing. That the ſame ſhould be made in each burgh; in number according to the ſubſtance of each burgh, and the leaſt of them to be of twenty tons: and that all idle men be compelled by the ſheriffs in the country to go on board the ſame."

Numerous indeed have been the attempts made at different periods to ſecure this treaſure to ourſelves, but without ſucceſs. In the late reign, a very ſtrong effort was made, and bounties allowed for the encouragement of Britiſh adventurers: the firſt was of 30s. per ton to every buſs of 70 tons and upwards. This bounty was afterwards raiſed to 50s. per ton, to be paid to ſuch adventurers as were entitled to it by claiming it at the places of rendezvous. The buſſes are from 20 to 90 tons burden, but the beſt ſize is 80. A veſſel of 80 tons ought to take ten laſts, or 120 barrels of herrings, to clear expences, the price of the fiſh to be admitted to be a guinea a barrel. A ſhip of this ſize ought to have 18 men, and three boats: one of 20 tons ſhould have ſix men; and every five tons above require an additional hand. To every ton are 280 yards of nets; ſo a veſſel of 80 tons carries 20,000 ſquare yards: each net is 12 yards long, and 10 deep, and every boat takes out from 20 to 30 nets, and puts them together, ſo as to form a long train; they are ſunk at each end of the train by a ſtone, which weighs it down to the full extent: the top is ſupported by buoys, made of ſheepsſkin, with a hollow ſtick at the mouth faſtened tight: through this the ſkin is blown up, and then ſtopped with a peg, to prevent the eſcape of the air. Sometimes theſe buoys are placed at the top of the nets: at other times the nets are ſuffered to ſink deeper, by the lengthening the cords faſtened to them, every cord being for that purpoſe 10 or 12 fathoms long. But the beſt fiſheries are generally in more ſhallow water. Fiſhery.

§ *Voyage to the Hebrides.* Of the Scots fiſhery in the Weſtern Iſles, the following account is given by Mr Pennant §. "The fiſhing is always performed in the night, unleſs by accident. The buſſes remain at anchor, and ſend out their boats a little before ſunſet; which continue out, in winter and ſummer, till day light; often taking up and emptying their nets, which they do 10 or 12 times in a night, in caſe of good ſucceſs. During winter it is a moſt dangerous and fatiguing employ, by reaſon of the greatneſs and frequency of the gales in theſe ſeas, and in ſuch gales are the moſt ſucceſsful captures: but by the Providence of heaven, the fiſhers are ſeldom loſt; and, what is wonderful, few are viſited with illneſs. They go out well prepared, with a warm great coat, boots, and ſkin aprons, and a good proviſion of beef and ſpirits. The ſame good fortune attends the buſſes, which in the tempeſtuous ſeaſon, and in the darkeſt nights, are continually ſhifting, in theſe narrow ſeas, from harbour to harbour. Sometimes 80 barrels of herrings are taken in a night by the boats of a ſingle veſſel. It once happened, in Loch Slappan, in Sky, that a buſs of 80 tons might have taken 200 barrels in one night, with 10,000 ſquare yards of net; but the maſter was obliged to deliſt, for want of a ſufficient number of hands to preſerve the capture. The herrings are preſerved by ſalting, after the entrails are taken out. This laſt is an operation performed by the country people, who get three halfpence per barrel for their trouble; and ſometimes, even in the winter, can gain fifteen pence a-day. This employs both women and children; but the ſalting is only intruſted to the crew of the buſſes. The fiſh are laid on their backs in the barrels, and layers of ſalt between them. The entrails are not loſt, for they are boiled into an oil: 8000 fiſh will yield ten gallons, valued at one ſhilling the gallon. A veſſel of 80 tons takes out 144 barrels of ſalt; a drawback of 2s. 8d. is allowed for each barrel uſed by the foreign or Iriſh exportation of the fiſh; but there is a duty of 1s. per barrel for the home conſumption, and the ſame

for

Fiſhery. for thoſe ſent to Ireland. The barrels are made of oak ſtaves chiefly from Virginia; the hoops from ſeveral parts of our own iſland, and are either of oak, birch, hazel or willow; the laſt from Holland, liable to a duty. The barrels coſt about 3s. each, they hold from 500 to 800 fiſh, according to the ſize of the fiſh; and are made to contain 32 gallons. The barrels are inſpected by proper officers; a cooper examines if they are ſtatutable and good; if faulty, he deſtroys them, and obliges the maker to ſtand to the loſs.

"Loch Broom has been celebrated for three or four centuries as the reſort of herrings. They generally appear here in July; thoſe that turn into this bay are part of the brigade that detaches itſelf from the weſtern column of that great army which annually deſerts the vaſt depths of the arctic circle, and comes, heaven-directed, to the ſeats of population, offered as a cheap food to millions, whom waſteful luxury or iron-hearted avarice hath deprived, by enhancing the price, of the wonted ſupports of the poor. The migration of theſe fiſh from their northern retreat is regular; their viſits to the Weſtern iſles and coaſts certain; but their attachment to one particular loch extremely precarious. All have their turns: that which ſwarmed with fiſh one year, is totally deſerted the following; yet the next loch to it may be crowded with the ſhoals. Theſe changes of place give often full employ to the buſſes, who are continually ſhifting their harbour in queſt of news reſpecting theſe important wanderers. They commonly appear here in July; the latter end of Auguſt they go into deep water, and continue there for ſome time, without any apparent cauſe: in November, they return to the ſhallows, when a new fiſhery commences, which continues till January: at that time the herrings become full of roe, and are uſeleſs as articles of commerce. Some doubt, whether thoſe herrings that appear in November are not part of a new migration; for they are as fat, and make the ſame appearance, as thoſe that compoſed the firſt. The ſigns of the arrival of the herrings are flocks of gulls, who catch up the fiſh while they ſkim on the ſurface, and of gannets, who plunge and bring them up from conſiderable depths. Both theſe birds are cloſely attended to by the fiſhers. Cod fiſh, haddocks, and dog fiſh, follow the herrings in vaſt multitudes: theſe voracious fiſh keep on the outſides of the columns, and may be a concurrent reaſon of driving the ſhoals into bays and creeks. In ſummer, they come into the bays generally with the warmeſt weather, and with eaſy gales. During winter, the hard gales from north-weſt are ſuppoſed to aſſiſt in forcing them into ſhelter. Eaſt winds are very unfavourable to the fiſhery."

Herrings are cured either white or pickled, or red.

Of the *firſt*, thoſe done by the Dutch are the moſt eſteemed, being diſtinguiſhed into four ſorts, according to their ſizes; and the beſt are thoſe that are fat, fleſhy, firm, and white, ſalted the ſame day they are taken, with good ſalt, and well barrelled. The Britiſh cured herrings are little inferior, if not equal, to the Dutch: for in ſpite of all their endeavours to conceal the ſecret, their method of curing, laſting, or caſking the herrings, has been diſcovered, and is as follows. After they have hauled in their nets, which they drag in the ſtern of their veſſels backwards and forwards in traverſing the coaſt, they throw them upon the ſhip's deck, which is cleared of every thing for that purpoſe: the crew is ſeparated into ſundry diviſions, and each diviſion has a peculiar taſk; one part opens and guts the herrings, leaving the milts and roes; another cures and ſalts them, by lining or rubbing their inſide with ſalt; the next packs them, and between each row and diviſion they ſprinkle handfuls of ſalt; laſtly, the cooper puts the finiſhing hand to all, by heading the caſks very tight, and ſtowing them in the hold. Fiſhery.

Red herrings muſt lie 24 hours in the brine, inaſmuch as they are to take all their ſalt there; and when they are taken out, they are ſpitted, that is, ſtrung by the head on little wooden ſpits, and then hung in a chimney made for that purpoſe. After which, a fire of bruſhwood, which yields a deal of ſmoke, but no flame, being made under them, they remain there till ſufficiently ſmoked and dried, and are afterwards barrelled up for keeping.

5. *Lobſter* FISHERY. Lobſters are taken along the Britiſh channel, and on the coaſt of Norway, whence they are brought to London for ſale; and alſo in the frith of Edinburgh, and on the coaſt of Northumberland. By 10 and 11 W. III. cap. 24. no lobſter is to be taken under eight inches in length, from the peak of the noſe to the end of the middle fin of the tail; and by 9 G. II. cap. 33. no lobſters are to be taken on the coaſt of Scotland from the 1ſt of June to the 1ſt of September.

6. *Mackerel* FISHERY. The mackerel is a ſummer fiſh of paſſage, found in large ſhoals, in divers parts of the ocean, not far north; but eſpecially on the French and Engliſh coaſts. The fiſhing is uſually in the months of April, May, and June, and even July, according to the place. They enter the Engliſh channel in April, and proceed up to the ſtraits of Dover as the ſummer advances; ſo that by June they are on the coaſts of Cornwall, Suſſex, Normandy, Picardy, &c. where the fiſhery is moſt conſiderable. They are an excellent food freſh; and not to be deſpiſed, when well prepared, pickled, and put up in barrels; a method of preſerving them chiefly uſed in Cornwall.

The fiſh is taken two ways; either with a line or nets: the latter is the more conſiderable, and is uſually performed in the night-time. The rules obſerved in the fiſhing for mackerel are much the ſame as thoſe already mentioned in the fiſhery of herrings.

There are two ways of pickling them: the firſt is, by opening and gutting them, and filling the belly with ſalt, crammed in as hard as poſſible with a ſtick; which done, they range them in ſtrata or rows, at the bottom of the veſſel, ſtrewing ſalt between the layers. In the ſecond way, they put them immediately into tubs full of brine, made of freſh water and ſalt; and leave them to ſteep, till they have imbibed ſalt enough to make them keep; after which, they are taken out, and barrelled up, taking care to preſs them cloſe down.

Mackerel are not cured or exported as merchandiſe, except a few by the Yarmouth and Leoſtoff merchants, but are generally conſumed at home; eſpecially in the city of London, and the ſea-ports between the Thames and Yarmouth, eaſt, and the Land's End of Cornwall, weſt.

7. *Oyſter*

Fishery.

7. *Oyster* FISHERY‡. This fishery is principally carried on at Colchester in Essex; Feversham and Milton in Kent; the Isle of Wight; the Swales of the Medway; and Tenby on the coast of Wales. From Feversham, and adjacent parts, the Dutch have sometimes loaded a hundred large boys with oysters in a year. They are also taken in great quantities near Portsmouth, and in all the creeks and rivers between Southampton and Chichester: many of which are carried about by sea to London and to Colchester, to be fed in the pits about Wavenhoe and other places.

‡ See *Ostrea*, *Conchology Index*.

8. *Pearl* FISHERY. See PEARL, CONCHOLOGY *Index*, and CEYLON.

9. *Pilchard* FISHERY. The chief pilchard fisheries are along the coasts of Dalmatia, on the coast of Bretagne, and along the coasts of Cornwall and Devonshire. That of Dalmatia is very plentiful: that on the coasts of Bretagne employs annually about 300 ships. Of the pilchard fishery on the coast of Cornwall the following account is given by Dr Borlase: "It employs a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, on land, in salting, pressing, washing and cleaning; in making boats, nets, ropes, casks, and all the trades depending on their construction and sale. The poor are fed with the offals of the captures, the land with the refuse of the fish and salt; the merchant finds the gains of commission and honest commerce, the fisherman the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off at the same time part of our tin. Of the usual produce of the great number of hogsheads exported each year for ten years from 1747 to 1756 inclusive, from the four ports of Fowey, Falmouth, Penzance, and St Ives, it appears that Fowey has exported yearly 1732 hogsheads; Falmouth, 14,631 hogsheads and two thirds; Penzance and Mounts-Bay 12,149 hogsheads and one third; St Ives, 1280 hogsheads: in all amounting to 29,795 hogsheads. Every hogshead for ten years last past, together with the bounty allowed for each hogshead exported, and the oil made out of each hogshead, has amounted, one year with another at an average, to the price of 1l. 13s. 3d.; so that the cash paid for pilchards exported has, at a medium, annually amounted to the sum of 49,532l. 10s."—The numbers that are taken at one shooting out of the nets are amazingly great. Mr Pennant says, that Dr Borlase assured him, that on the 5th of October 1767, there were at one time enclosed in St Ives's Bay 7000 hogsheads, each hogshead containing 35,000 fish, in all 245 millions.

The pilchards naturally follow the light, which contributes much to the facility of the fishery; the season is from June to September. On the coasts of France they make use of the roes of the cod fish as a bait; which, thrown into the sea, makes them rise from the bottom, and run into the nets. On our coasts there are persons posted ashore, who, spying by the colour of the water where the shoals are, make signs to the boats to go among them to cast their nets. When taken, they are brought on shore to a warehouse, where they are laid up in broad piles, supported with backs and sides; and as they are piled, they salt them with bay salt; in which lying to soak for 30 or 40 days, they run out a deal of blood, with dirty pickle and bittern: then they wash them clean in sea water; and, when dry, barrel and press them hard down to squeeze out the oil, which issues out at a hole in the bottom of the cask. Fishes

10. *Salmon* FISHERY. The chief salmon fisheries in Europe are in England, Scotland, and Ireland, in the rivers, and sea coasts adjoining to the river mouths. The most distinguished for salmon in Scotland are, the river Tweed, the Clyde, the Tay, the Dee, the Don, the Spey, the Ness, the Bewly, &c. in most of which it is very common, about the height of summer, especially if the weather happens to be very hot, to catch four or five score salmon at a draught. The chief rivers in England for salmon are, the Tyne, the Trent, the Severn, and the Thames. The fishing is performed with nets, and sometimes with a kind of locks or wears made on purpose, which in certain places have iron or wooden grates so disposed, in an angle, that being impelled by any force in a contrary direction to the course of the river, they may give way and open a little at the point of contact, and immediately shut again, closing the angle. The salmon, therefore, coming up into the rivers, are admitted into these grates, which open, and suffer them to pass through, but shut again, and prevent their return. The salmon is also caught with a spear, which they dart into him when they see him swimming near the surface of the water. It is customary likewise to catch them with a candle and lanthorn, or wisp of straw set on fire; for the fish naturally following the light, are struck with the spear, or taken in a net spread for that purpose, and lifted with a sudden jerk from the bottom. † See *Ichthyology Index*.

"The capture of salmon in the Tweed, about the month of July (says Mr Pennant†) is prodigious. In a good fishery, often a boat load, and sometimes near two, are taken in a tide: some few years ago there were above 700 fish taken at one hawl, but from 50 to 100 is very frequent. The coopers in Berwick then begin to salt both salmon and grilses in pipes and other large vessels, and afterwards barrel them to send abroad, having then far more than the London markets can take off their hands. † *Brit. Z* III. 289.

"Most of the salmon taken before April, or to the setting in of the warm weather, is sent fresh to London in baskets: unless now and then the vessel is disappointed by contrary winds of sailing immediately; in which case the fish is brought ashore again to the coopers offices, and boiled, pickled, and kitted, and sent to the London markets by the same ship, and fresh salmon put in the baskets in lieu of the stale ones. At the beginning of the season, when a ship is on the point of sailing, a fresh clean salmon will sell from a shilling to eighteen pence a pound; and most of the time that this part of the trade is carried on, the prices are from five to nine shillings per stone; the value rising and falling according to the plenty of fish, or the prospect of a fair or foul wind. Some fish are sent in this manner to London the latter end of September, when the weather grows cool; but then the fish are full of large roes, grow very thin bellied, and are not esteemed either palatable or wholesome.

"The season for fishing in the Tweed begins November 30th, but the fishermen work very little till after Christmas: it ends on Michaelmas day; yet the corporation of Berwick (who are conservators of the river)

Fishery. river) indulge the fishermen with a fortnight past that time, on account of the change of the style.

"There are on the river 41 considerable fisheries, extending upwards about 14 miles from the mouth, (the others above being of no great value), which are rented for near 5400l. per annum: the expence attending the servants wages, nets, boats, &c. amount to 5000l. more; which together makes up the sum 10,400l. Now, in consequence, the produce must defray all, and no less than 20 times that sum of fish will effect it; so that 208,000 salmon must be caught there one year with another.

"Scotland possesses great numbers of fine fisheries on both sides of that kingdom. The Scotch in early times had most severe laws against the killing of this fish; for the third offence was made capital, by a law of James IV. Before that, the offender had power to redeem his life. They were thought in the time of Henry VI. a present worthy of a crowned head: for in that reign the queen of Scotland sent to the duchess of Clarence 10 casks of salted salmon; which Henry directed to pass duty free. The salmon are cured in the same manner as at Berwick, and a great quantity is sent to London in the spring; but after that time, the adventurers begin to barrel and export them to foreign countries; but we believe that commerce is far less lucrative than it was in former times, partly owing to the great increase of the Newfoundland fishery, and partly to the general relaxation of the discipline of abstinence in the Romish church.

"Ireland (particularly the north) abounds with this fish: the most considerable fishery is at Cranna, on the river Ban, about a mile and a half from Coleraine. When I made the tour of that hospitable kingdom in 1754, it was rented by a neighbouring gentleman for 620l. a-year; who assured me, that the tenant, his predecessor, gave 1600l. per annum, and was a much greater gainer by the bargain, for the reasons before mentioned, and on account of the number of the poachers who destroy the fish in the fence months.

"The mouth of this river faces the north; and is finely situated to receive the fish that roam along the coast in search of an inlet into some fresh water, as they do all along that end of the kingdom which opposes itself to the northern ocean. We have seen near Ballicastle, nets placed in the sea at the foot of the promontories that jut into it, which the salmon strike into as they are wandering close to shore; and numbers are taken by that method.

"In the Ban they fish with nets 18 score yards long, and are continually drawing night and day the whole season, which we think lasts about four months, two sets of 16 men each alternately relieving one another. The best drawing is when the tide is coming in: we were told, that at a single draught there were once 840 fish taken.

"A few miles higher up the river is a wear where a considerable number of fish that escape the nets are taken. We were lately informed, that, in the year 1760, about 320 tons were taken in the Cranna fishery."

Curing Salmon. When the salmon are taken, they open them along the back, take out the guts and gills, and cut out the greatest part of the bones, endeavouring to make the inside as smooth as possible; they then salt the fish in large tubs for the purpose, where they lie a considerable time soaking in brine; and about October, they are packed close up in barrels, and sent to London, or exported up the Mediterranean. They have also in Scotland a great deal of salmon salted in the common way, which after soaking in brine a competent time, is well pressed, and then dried in smoke: this is called *kipper*, and is chiefly made for home consumption; and if properly cured and prepared, is reckoned very delicious. Fishery.

Sturgeon † *Fishery.* The greatest sturgeon fishery is in the mouth of the Volga, on the Caspian sea: where the Muscovites employ a great number of hands, and catch them in a kind of enclosure, formed by huge stakes representing the letter Z repeated several times. These fisheries are open on the side next the sea, and close on the other; by which means the fish ascending in its season up the river, is embarrassed in these narrow angular retreats, and so is easily killed with a harping iron. Sturgeons, when fresh, eat deliciously; and in order to make them keep, they are salted or pickled in large pieces, and put up in cags from 30 to 50 pounds. But the great object of this fishery is the roe, of which the Muscovites are extremely fond, and of which is made the cavear, or kavia, so much esteemed by the Italians. See CAVEAR.

† See *Acipenser, Ichthyology Index.*

Tunny Fishery. The tunny (a species of SCOMBER), was a fish well known to the ancients, and made a great article of commerce: And there are still very considerable tunny fisheries on the coasts of Sicily, as well as several other parts of the Mediterranean.

The nets are spread over a large space of sea by means of cables fastened to anchors, and are divided into several compartments. The entrance is always directed, according to the season, towards that part of the sea from which the fish are known to come. A man placed upon the summit of a rock high above the water, gives a signal of the fish being arrived; for he can discern from that elevation what passes under the waters infinitely better than any person nearer the surface. As soon as notice is given that the shoal of fish has penetrated as far as the inner compartment, or the chamber of death, the passage is drawn close, and the slaughter begins.

The undertakers of these fisheries pay an acknowledgment to the king, or the lord upon whose land they fix the main stay or foot of the tonnara; they make the best bargain they can: and, till success has crowned their endeavours, obtain this leave for a small consideration; but the rent is afterwards raised in proportion to their capture.

The tunny enters the Mediterranean about the vernal equinox, travelling in a triangular phalanx, so as to cut the waters with its point, and to present an extensive base for the tides and currents to act against, and impel forwards. These fish repair to the warm seas of Greece to spawn, steering their course thither along the European shores, but as they return, approach the African coast; the young fry is placed in the van of the squadron as they travel. They come back from the east in May, and abound on the coast of Sicily and Calabria about that time. In autumn they steer northward, and frequent the neighbourhood of Amalfi and Naples; but during the whole season straggglers are occasionally caught.

When

Fiſhery. When taken in May, the uſual time of their appearance in the Calabrian bays, they are full of ſpawn, and their fleſh is then eſteemed unwholeſome, apt to occaſion headachs and vapours; the milts and roes are particularly ſo at that ſeaſon. To prevent theſe bad effects, the natives fry them in oil, and afterwards ſalt them. The quantity of this fiſh conſumed annually in the Two Sicilies almoſt exceeds the bounds of calculation. From the beginning of May to the end of October it is eaten freſh, and all the reſt of the year it is in uſe ſalted. The moſt delicate part is the muzzle. The belly ſalted was called *tarantallum*, and accounted a great delicacy by the Romans; its preſent name is *Surra*. The reſt of the body is cut into ſlices, and put into tubs.

Turbot FISHERY. Turbots grow to a large ſize, ſome of them weighing from 23 to 30 pounds. They are taken chiefly off the north coaſt of England, and others off the Dutch coaſt. The large turbot (as well as ſeveral other kinds of flat fiſh) are taken by the hook and line, for they lie in deep water; the method of taking them in wears or ſtaked nets being very precarious. When the fiſhermen go out to fiſh, each perſon is provided with three lines, which are coiled on a flat oblong piece of wicker work; the hooks being baited, and placed regularly in the centre of the coil. Each line is furniſhed with 14 ſcore of hooks, at the diſtance of ſix feet two inches from each other. The hooks are faſtened to the lines upon ſneads of twiſted horſe hair 27 inches in length. When fiſhing, there are always three men in each coble, and conſequently nine of theſe lines are faſtened together, and uſed in one line, extending in length near three miles, and furniſhed with 2520 hooks. An anchor and a buoy are fixed at the firſt end of the line, and one more of each at the end of each man's lines; in all four anchors, which are common perforated ſtones, and four buoys made of leather or cork. The line is always laid acroſs the current. The tides of flood and ebb continue an equal time upon our coaſt, and, when undiſturbed by winds, run each way about ſix hours; they are ſo rapid that the fiſhermen can only ſhoot and haul their lines at the turn of tide, and therefore the lines always remain upon the ground about ſix hours; during which time the *myxine glutinoſa* of Linnæus will frequently penetrate the fiſh that are on the hooks, and entirely devour them, leaving only the ſkin and bones. The ſame rapidity of tides prevents their uſing hand lines; and therefore two of the people commonly wrap themſelves in the ſail, and ſleep while the other keeps a ſtrict look-out, for fear of being run down by ſhips, and to obſerve the weather. For ſtorms often riſe ſo ſuddenly, that it is with extreme difficulty they can ſometimes eſcape to the ſhore, leaving their lines behind.

Beſides the coble, the fiſhermen have alſo a five men boat, which is 40 feet long and 15 broad, and 25 tons burden; it is ſo called, though navigated by ſix men and a boy, becauſe one of the men is commonly hired to cook, &c. and does not ſhare in the profits with the other five. This boat is decked at each end, but open in the middle, and has two large lug ſails. All our able fiſhermen go in theſe boats to the herring fiſhery at Yarmouth in the latter end of September, and return about the middle of November. The boats are then laid up till the beginning of Lent, at which time they go off in them to the edge of the Dogger, and other places, to fiſh for turbot, cod, ling, ſkates, &c. They always take two cobles on board; and when they come upon their ground, anchor the boat, throw out the cobles, and fiſh in the ſame manner as thoſe do who go from the ſhore in a coble; with this difference only, that here each man is provided with double the quantity of lines, and inſtead of waiting the return of the tide in the coble, return to their boat and bait their other lines; thus hawling one ſet and ſhooting another every turn of tide. They commonly run into harbour twice a-week to deliver their fiſh. Fiſhery

The beſt bait is freſh herring cut in pieces of a proper ſize; the five men boats are always furniſhed with nets for taking them. Next to herrings are the leſſer lampreys. The next baits in eſteem are ſmall haddocks cut in pieces, ſand worms, and limpets, here called *ſlidders*; and when none of theſe can be had, they uſe bullock's liver. The hooks are two inches and a half long in the ſhank, and near an inch wide between the ſhank and the point. The line is made of ſmall cording, and is always tanned before it is uſed.

Turbots are extremely delicate in their choice of baits; for if a piece of herrring or haddock has been 12 hours out of the ſea, and then uſed as bait, they will not touch it.

Whale FISHERY. See BALÆNA, CETOLOGY *Index*.

Whales are chiefly caught in the north ſeas; the largeſt ſort are found about Greenland or Spitzbergen. At the firſt diſcovery of this country, whales not being uſed to be diſturbed, frequently came into the very bays, and were accordingly killed almoſt cloſe to the ſhore; ſo that the blubber being cut off was immediately boiled into oil on the ſpot. The ſhips in thoſe times took in nothing but the pure oil and the whalebone, and all the buſineſs was executed in the country; by which means a ſhip could bring home the product of many more whales than ſhe can, according to the preſent method of conducting this trade. The fiſhery alſo was then ſo plentiful, that they were obliged ſometimes to ſend other ſhips to fetch off the oil they had made, the quantity being more than the fiſhing ſhips could bring away. But time and change of circumſtances have ſhifted the ſituation of this trade. The ſhips coming in ſuch numbers from Holland, Denmark, Hamburgh, and other northern countries, all intruders upon the Engliſh, who were the firſt diſcoverers of Greenland, the whales were diſturbed, and gradually, as other fiſh often do, forſaking the place, were not to be killed ſo near the ſhore as before; but are now found, and have been ſo ever ſince, in the openings and ſpace among the ice, where they have deep water, and where they go ſometimes a great many leagues from the ſhore.

The whale fiſhery begins in May, and continues all June and July; but whether the ſhips have good or bad ſucceſs, they muſt come away, and get clear of the ice, by the end of Auguſt; ſo that in the month of September at fartheſt they may be expected home; but a ſhip that meets with a fortunate and early fiſhery in May may return in June or July.

But, for the manner of taking whales, and for a farther account of the whale fiſhery, as a trade, ſee CETOLOGY.

FISHGARD, or FISGARD, a town of Pembrokeſhire, ſituated on a ſteep cliff on the ſea-ſhore, 254 miles from

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from London, at the influx of the river Gwaine into the sea, which here forms a spacious bay. It is governed by a mayor, a bailiff, and other officers; and here vessels may lie safely in five or six fathoms water. The inhabitants have a good trade in herrings, and annually cure, between Fisgard and Newport, above 1000 barrels of them. The town sends one member to parliament.

FISHING, in general, the art of catching fish, whether by means of nets, of spears, or of the line and hook.

FISHING in the great, performed by the net, spear, or harpoon, for fish that go in shoals, has been explained in the preceding article. That performed by the rod, line, and hook, for solitary fish, is usually termed ANGLING: See that article; and for the particular manner of angling for the different kinds of fish, see their respective names, as DACE, EEL, PERCH, under ICHTHYOLOGY.

Here we shall give an account of the following:

† See *Cyprinus, Ichthyology Index.*

1. The *Barbel* †, so called on account of the barb or beard that is under his chops), though a coarse fish, gives considerable exercise to the angler's ingenuity. They swim together in great shoals, and are at their worst in April, at which time they spawn, but come soon in season; the places whither they chiefly resort, are such as are weedy and gravelly rising grounds, in which this fish is said to dig and root with his nose like a swine. In the summer he frequents the strongest, swiftest, currents of water; as deep bridges, wears, &c. and is apt to settle himself among the piles, hollow places, and moss, or weeds; and will remain there immoveable; but in the winter he retires into deep waters, and helps the female to make a hole in the sands to hide her spawn in, to hinder its being devoured by other fish. He is a very curious and cunning fish; for if his baits be not sweet, clean, well scoured, and kept in sweet moss, he will not bite; but well ordered and curiously kept, he will bite with great eagerness. The best bait for him is the spawn of a salmon, trout, or any other fish; and if you would have good sport with him, bait the places where you intend to fish with it a night or two before, or with large worms cut in pieces; and the earlier in the morning or the later in the evening that you fish, the better it will be. Your rod and line must be both strong and long, with a running plummet on the line; and let a little bit of lead be placed a foot or more above the hook, to keep the bullet from falling on it; so the worm will be at the bottom, where they always bite; and when the fish takes the bait, your plummet will lie and not choke him. By the bending of your rod you may know when he bites, as also with your hand you will feel him make a strong snatch; then strike, and you will rarely fail, if you play him well; but if you manage him not dexterously, he will break your line. The best time for fishing is about nine in the morning, and the most proper season is the latter end of May, June, July, and the beginning of August.

Sportf. Dict.

See *Cyprinus, Ichthyology Index.*

2. The *Bleak* ‡, is an eager fish, caught with all sorts of worms bred on trees or plants; as also with flies, paste, sheep's blood, &c. They may be angled for with half a score of hooks at once, if they can be all fastened on; he will also in the evening take a natural or artificial fly. If the day be warm and clear, there is no fly so good for him as the small fly at the top of the water, which he will take at any time of the day, especially in the evening; but if the day is cold and cloudy, gentles and caddis are the best; about two feet under water. No fish yields better sport to a young angler than the bleak. It is so eager, that it will leap out of the water for a bait.

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There is another way of taking bleak, which is by whipping them in a boat, or on a bank side in fresh water in a summer's evening, with a hazel top about five or six feet long and a line twice the length of the rod. But the best method is with a drabble, thus: Tie eight or ten small hooks across a line two inches above one another; the biggest hook the lowermost, (whereby you may sometimes take a better fish), and bait them with gentles, flies, or some small red worms, by which means you may take half a dozen or more at a time.

3. For the *Bream* ||, observe the following directions, which will also be of use in carp fishing.—Procure about a quart of large red worms; put them into fresh moss well washed and dried every three or four days, feeding them with fat mould and chopped fennel, and they will be thoroughly scoured in about three weeks.

|| See *Cyprinus, Ichthyology Index*

Let your lines be silk and hair, but all silk is the best; let the floats be either swan-quills or goose-quills. Let your plumb be a piece of lead in the shape of a pear, with a small ring at the little end of it; fasten the lead to the line, and the line hook to the lead, about ten or twelve inches space between lead and hook will be enough; and take care the lead be heavy enough to sink the float. Having baited your hook well with a strong worm, the worm will draw the hook up and down in the bottom, which will provoke the bream to bite the more eagerly. It will be best to fit up three or four rods and lines in this manner, and set them as will be directed, and this will afford you much the better sport. Find the exact depth of the water if possible, that your float may swim on its surface directly over the lead; then provide the following ground bait. Take about a peck of sweet gross-ground malt; and having boiled it a very little, strain it hard through a bag, and carry it to the water side where you have founded; and in the place where you suppose the fish frequent, there throw in the malt by handfuls squeezed hard together, that the stream may not separate it before it comes to the bottom; and be sure to throw it in at least a yard above the place where you intend the hook shall lie, otherwise the stream will carry it down too far. Do this about nine o'clock at night, keeping some of the malt in the bag, and go to the place about three the next morning; but approach very warily, lest you should be seen by the fish; for it is certain that they have their centinels watching on the top of the water, while the rest are feeding below. Having baited your hook so that the worm may crawl to and fro, the better to allure the fish to bite, cast it in at the place where you find the fish to stay most, which is generally in the broadest and deepest part of the river, and so that it may rest about the midst of your bait that is on the ground. Cast in your second line so that it may reil a yard above that, and a third about a yard below it. Let your rods lie on the bank with some stones to keep them down at the great ends; and then withdraw yourself, yet not so far but that you can have your eye upon

Sportf. Dict.

Fiſhing. upon all the floats; and when you ſee one bitten and carried away, do not be too haſty to run in, but give time to the fiſh to tire himſelf, and then touch him gently. When you perceive the float ſink, creep to the water ſide, and give it as much line as you can. If it is a bream or carp, they will run to the other ſide; which ſtrike gently, and hold your rod at a bent a little while; but do not pull, for then you will ſpoil all; but you muſt firſt tire them before they can be landed, for they are very ſhy. If there are any carps in the river, it is an even wager that you take one or more of them; but if there are any pike or perch, they will be ſure to viſit the ground bait, though they will not touch it, being drawn thither by the great reſort of the ſmall fiſh; and until you remove them, it is in vain to think of taking the bream or carp. In this caſe, bait one of your hooks with a ſmall bleak, roach, or gudgeon, about two feet deep from your float, with a little red worm at the point of your hook; and if a pike be there, he will be ſure to ſnap at it. This ſport is good till nine o'clock in the morning; and, in a gloomy day, till night; but do not frequent the place too much, leſt the fiſh grow ſhy.

† See *Carp*, and *Cyprinus*.

4. The *carp* †. A perſon who angles for carp muſt arm himſelf with abundance of patience, becauſe of its extraordinary ſubtility and policy; they always chooſe to lie in the deepeſt places, either of ponds or rivers, where there is but a ſmall running ſtream.

Further, obſerve, that they will ſeldom bite in cold weather; and you cannot be too early or too late at the ſpot in hot weather; and if he bite, you need not fear his hold; for he is one of thoſe leather-mouthed fiſh that have their teeth in their throat.

Neither muſt you forget, in angling for him, to have a ſtrong rod and line; and ſince he is ſo very wary, it will be proper to entice him, by baiting the ground with a coarſe paſte.

He ſeldom refuſes the red worm in March, the caddis in June, or the graſhopper in June, April, and September.

This fiſh does not only delight in worms, but alſo in ſweet paſte; of which there is great variety; the beſt is made of honey and ſugar, and ought to be thrown into the water ſome hours before you begin to angle; neither will ſmall pellets thrown into the water two or three days before be worſe for this purpoſe, eſpecially if chickens guts, garbage, or blood mixed with bran and cow dung, be alſo thrown in.

But more particularly, as to a paſte very proper for this uſe, you may make it in the manner following: Take a ſufficient quantity of flour, and mingle it with veal, cut ſmall, making it up with a compound of honey; then pound all together in a mortar till they are ſo tough as to hang upon the hook without waſhing off. In order to effect which the better, mingle whitiſh wool with it; and if you keep it all the year round, add ſome virgin wax and clarified honey.

Again, If you fiſh with gentles, anoint them with honey, and put them on your hook, with a deep ſcarlet dipped in the like, which is a good way to deceive the fiſh.

Honey and crumbs of wheat bread, mixed together, make alſo a very good paſte.

In taking a carp either in pond or river, if the angler intends to add profit to his pleaſure, he muſt take a peck of ale-grains, and a good quantity of any blood to mix with the grains, baiting the ground with it where he intends to angle. This food will wonderfully attract the ſcale-fiſh, as carp, tench, roach, dace, and bream. Fiſhing.

Let him angle in a morning, plumbing his ground, and angling for carp with a ſtrong line: the bait muſt be either paſte or a knotted red worm; and by this means he will have ſport enough.

Deſcription of proper Baits for the ſeveral ſorts of FISH *referred to in the annexed Table.*

Flies.] 1. Stone fly, found under hollow ſtones at the ſides of rivers, is of a brown colour, with yellow ſtreaks on the back and belly, has large wings, and is in ſeaſon from April to July. 2. Green drake, found among ſtones by river ſides, has a yellow body ribbed with green, is long and ſlender, with wings like a butterfly, his tail turns on his back, and from May to Midſummer is very good. 3. Oak-fly, found in the body of an oak or aſh, with its head downwards, is of a brown colour, and excellent from May to September. 4. Palmer fly or worm, found on leaves of plants, is commonly called a *caterpillar*, and when it comes to a fly is excellent for trout. 5. Ant fly, found in ant hills from June to September. 6. The May fly is to be found playing at the river ſide, eſpecially againſt rain. 7. The black fly is to be found upon every hawthorn after the buds are come off.

Paſtes.] 1. Take the blood of ſheep's hearts, and mix it with honey and flour worked to a proper conſiſtence. 2. Take old cheeſe grated, a little butter ſufficient to work it, and colour it with ſaffron: in winter uſe ruſty bacon inſtead of butter. 3. Crumbs of bread chewed or worked with honey or ſugar, moiſtened with gum ivy water. 4. Bread chewed, and worked in the hand till ſtiff.

Worms.] 1. The earth bob, found in ſandy ground after ploughing; it is white, with a red head, and bigger than a gentle: another is found in heathy ground, with a blue head. Keep them in an earthen veſſel well covered, and a ſufficient quantity of the mould they harbour in. They are excellent from April to November. 2. Gentles, to be had from putrid fleſh: let them lie in wheat bran a few days before uſed. 3. Flag worms, found in the roots of flags; they are of a pale yellow colour, are longer and thinner than a gentle, and muſt be ſcowered like them. 4. Cow-turd bob, or clap bait, found under a cow turd from May to Michaelmas; it is like a gentle, but larger. Keep it in its native earth like the earth bob. 5. Caddis worm, or cod bait, found under looſe ſtones in ſhallow rivers; they are yellow, bigger than a gentle, with a black or blue head, and are in ſeaſon from April to July. Keep them in flannel bags. 6. Lob worm, found in gardens; it is very large, and has a red head, a ſtreak down the back, and a flat broad tail. 7. Marſh-worms, found in marſhy ground; keep them in moſs ten days before you uſe them: their colour is a bluiſh red, and are a good bait from March to Michaelmas. 8. Brandling red worms, or blood worms found in rotten dunghills and tanners bark; they are ſmall red worms, very good for all ſmall fiſh, have ſometimes a yellow tail, and are called *tag-tail.*

Fiſhing. *Fiſh and Inſects.*] 1. Minnow. 2. Gudgeon. 3. Roach. 4. Dace. 5. Smelt. 6. Yellow frog. 7. Snail ſlit. 8. Graſhopper.

Fishing Fly, a bait uſed in angling for divers kinds of fiſh. See Fishing.

The fly is either *natural* or *artificial*.

I. *Natural* flies are innumerable. The more uſual for this purpoſe are mentioned in the preceding page.

The are two ways to fiſh with natural flies; either on the ſurface of the water, or a little underneath it.

In angling for chevin, roach, or dace, move not your natural fly ſwiftly when you ſee the fiſh make at it: but rather let it glide freely towards him with the ſtream: but if it be in a ſtill and ſlow water, draw the fly ſlowly ſidewiſe by him, which will make him eagerly purſue.

II. The *artificial* fly is ſeldom uſed but in bluſtering weather, when the waters are ſo troubled by the winds, that the natural fly cannot be ſeen, nor reſt upon them. Of this artificial fly there are reckoned no leſs than 12 ſorts, of which the following are the principal.

1. For March, the dun fly; made of dun wool, and the feathers of the partridge's wing; or the body made of black wool, and the feathers of a black drake. 2. For April, the ſtone fly; the body made of black wool, dyed yellow under the wings and tail. 3. For the beginning of May, the ruddy fly; made of red wool, and bound about with black ſilk, with the feathers of a black capon hanging dangling on his ſides next his tail. 4. For June, the greeniſh fly; the body made of black wool, with a yellow liſt on either ſide, the wings taken off the wings of a buzzard, bound with black broken ſhemp. 5. The mooriſh fly, the body made of duſkiſh wool, and the wings of the blackiſh mail of a drake. 6. The tawny fly, good till the middle of June; the body made of tawny wool, the wings made contrary one againſt the other of the whitiſh mail of a white drake. 7. For July, the waſp fly; the body made of black wool, caſt about with yellow ſilk, and the wings of drakes feathers. 8. The ſteel fly; good in the middle of July; the body made with greeniſh wool, caſt about with the feathers of a peacock's tail, and the wings made of thoſe of the buzzard. 9. For Auguſt, the drake fly; the body made with black wool caſt about with black ſilk; his wings of the mail of a black drake, with a black head.

The beſt rules for artificial fly fiſhing are,

1. To fiſh in a river ſomewhat diſturbed with rain: or in a cloudy day, when the waters are moved by a gentle breeze: the ſouth wind is beſt; and if the wind blow high, yet not ſo but that you may conveniently guard your tackle, the fiſh will riſe in plain deeps; but if the wind be ſmall, the beſt angling is in ſwift ſtreams. 2. Keep as far from the water ſide as may be; fiſh down the ſtream with the ſun at your back, and touch not the water with your line. 3. Ever angle in clear rivers, with a ſmall fly and ſlender wings; but in muddy places, uſe a larger. 4. When, after rain, the water becomes browniſh, uſe an orange fly; in a clear day, a light-coloured fly; a dark fly for dark waters, &c. 5. Let the line be twice as long as the rod, unleſs the river be encumbered with wood. 6. For every ſort of fly, have ſeveral of the ſame differing in colour, to ſuit with the different complexions of ſeveral waters and weathers. 7. Have a nimble eye, and active hand, to ſtrike preſently with the riſing of the fiſh; or elſe he will be apt to ſpue out the hook. 8. Let the fly fall firſt into the water, and not the line, which will ſcare the fiſh. 9. In ſlow rivers, or ſtill places, caſt the fly acroſs the river, and let it ſink a little in the water, and draw it gently back with the current. Fiſhing.

Salmon flies ſhould be made with their wings ſtanding one behind the other, whether two or four. This fiſh delights in the gaudieſt colours that can be; chiefly in the wings, which muſt be long, as well as the tail.

Fishing by means of birds, a method peculiar to the Chineſe, who train certain birds for the purpoſe in the ſame manner as falcons are taught to purſue game. For this purpoſe they have trained a ſpecies of pelican, reſembling the common corvorant, which they call the *Leu-tze*, or fiſhing bird. Sir George Staunton, who, when the embaſſy was proceeding on the ſouthern branch of the great canal, ſaw thoſe birds employed, tells us, that on a large lake, cloſe to the eaſt ſide of the canal, are thouſands of ſmall boats and rafts, built entirely for this ſpecies of fiſhery. On each boat or raft are ten or a dozen birds, which, at a ſignal from the owner, plunge into the water; and it is aſtoniſhing to ſee the enormous ſize of fiſh with which they return, graſped within their bills. They appeared to be ſo well trained, that it did not require either ring or cord about their throats to prevent them from ſwallowing any portion of their prey, except what their maſter was pleaſed to return to them for encouragement and food. The boat uſed by theſe fiſhermen is of a remarkable light make, and is often carried to the lake, together with the fiſhing birds, by the men who are there to be ſupported by it.

The ſame author ſaw the fiſhermen buſy on the great lake Wee-chaung-hee; and he gives the following account of a very ſingular method practiſed by them for catching the fiſh of the lake without the aid of birds, of net, or of hooks. To one ſide of a boat a flat board, painted white, is fixed, at an angle of about 45 degrees, the edge inclining towards the water. On moonlight nights the boat is ſo placed that the painted board is turned to the moon, from whence the rays of light ſtriking on the whitened ſurface, give to it the appearance of moving water; on which the fiſh being tempted to leap as on their element, the boatmen raiſing with a ſtring the board, turn the fiſh into the boat.

Water-fowl are much ſought after by the Chineſe, and are taken upon the ſame lake by the following ingenious device. Empty jars or gourds are ſuffered to float about upon the water, that ſuch objects may become familiar to the birds. The fiſherman then wades into the lake with one of thoſe empty veſſels upon his head, and walks gently towards a bird; and lifting up his arm, draws it down below the ſurface of the water without any diſturbance or giving alarm to the reſt, ſeveral of whom he treats in the ſame manner, until he fills the bag he had brought to hold his prey. The contrivance itſelf is not ſo ſingular, as it is that the ſame exactly ſhould have occurred in the new continent, as

An Epitome of the whole art of FISHING, wherein is ſhown (at one view), the harbours, ſeaſons, and depths, for catching all ſorts of fiſh uſually angled for; alſo the various baits for each, ſo digeſted as to contain the eſſence of all the treatiſes ever written on the ſubject, exempt from the ſuperfluities, which tend more to perplex than inſtruct.

Names.	*Where found.*	*Seaſon.*	*Time to ang.*	*Depth from ground.*	*Proper Baits.*			
					Flies. N°	Paſtes. N°	Worms. N°	Fiſh and Inſects.
Bream	Rough ſtr. river or mid. pond	Apr. to Mich.	Sunriſe to 9 3 to Sunſet	Touch ground	-	1 3	1 to 7	N° 8.
Barbel	Gravel banks in currents under bridges	Apr. to Aug.	Very early or late	Ditto	-	2	2 6 7	-
Bleak	Sandy bottom, deep rivers, ſhips ſterns	May to Oct.	All day	Six inches from bottom	1 2	2	2 3 8	-
Carp	Still deep mud bottom, pond or river	May to Aug.	Sunriſe to 9 3 to Sunſet	Three inches from bottom Hot weather, mid water	-	1 3 4	1 2 3 4 7	-
Chub or Chevin	Ditto	May to Dec.	Ditto	Ditto	1 to 5	2	1 2 4 5	7 8
Dace	Sandy bottom deep rivers, ſhips ſterns	May to Oct.	All day	Six to 12 inches from bottom	Ditto	3 4	1 to 5 & 8	-
Gudgeon	Gravel ſhoals	May to Oct.	Ditto	Near or on the ground	-	Ditto	2 8	-
Pike	Near clay banks	All the year.	Ditto	Mid water	Wh. ſtro. and ſnap	Line float Hook fixt	- On ſhore	1 2 3 4 5 6 7
Perch	River in ſtream (gravel or weedy)	May to Aug.	Sunriſe to 10 2 to Sunſet	Ditto	2	1	3 5 7 8	1 6
	Pond deepeſt part (bottom)	Aug. to May	Mid day	Six inches from bottom				
Pope	Deep holes in rivers	May to Oct.	All day	Ditto	5	-	All	-
Roach	Sandy bottom, deep rivers, ſhips ſterns	May to Oct.	Ditto	Six to 12 inches	1 2 4 5	3 4	Ditto	8
Salmon	Deep rivers	Mar. to Sept.	8 to 9, 3 to 6	Mid way to the bottom	All large	-	1 5 6 7	1
Smelts	Ships ſterns and docks	Apr. to Oct.	All day	Mid way to the bottom Variable	All ſmall	-	1 2 5	Bits of ſmelts
Trout	Purling ſtream and eddies of ſtony bottom river	Mar. to Mich.	Ditto	Cold weather, 6 inches to 9 Hot weather, top to mid wat.	1 to 5	-	1 2 5 to 8	1 8
Tench	Mud bottom river or pond	All the year.	Sunriſe to 9 3 to Sunſet	Cold wea. 3 inches from bot. Hot weather, mid water	-	1 3 4	1 3 4 to 7	-
Umber or Grayling	Clay bottom, ſwift ſtream	All the year.	All day	Cold weather, 6 to 9 inches Hot weather, top to mid wat.	1 to 5	-	All	1 8

Fiſhing. Ulloa aſſerts, to the natives of Carthagena, upon the lake Cienega de Teſas.

FISHING Floats, are little appendages to the line, ſerving to keep the hook and bait ſuſpended at the proper depth, to diſcover when the fiſh has hold of them, &c. Of theſe there are divers kinds; ſome made of Muſcovy duck quills, which are the beſt for flow waters; but for ſtrong ſtreams, found cork, without flaws or holes, bored through with a hot iron, into which is put a quill of a fit proportion, is preferable: pare the cork to a pyramidal form, and make it ſmooth. Fiſhing.

FISHING Hook, a ſmall inſtrument made of ſteel wire, of a proper form to catch and retain fiſh.

The fiſhing hook, in general, ought to be long in the ſhank, ſomewhat thick in the circumference, the point even and ſtraight; let the bending be in the ſhank.

For

Fiſhing, Fiſſures.

For ſetting the hook on, uſe ſtrong but ſmall ſilk, laying the hair on the inſide of your hook; for if it be on the outſide, the ſilk will fret and cut it aſunder.

There are ſeveral ſizes of theſe fiſhing hooks, ſome big, ſome little: and of theſe, ſome have peculiar names; as, 1. Single hooks. 2. Double hooks; which have two bendings, one contrary to the other. 3. Snappers, or gorgers, which are the hooks to whip the artificial fly upon, or bait with the natural fly. 4. Springers, or ſpring hooks; a kind of double hooks, with a ſpring, which flies open upon being ſtruck into any fiſh, and ſo keeps its mouth open.

Fishing-Line, is either made of hair twiſted; or ſilk; or the Indian graſs. The beſt colours are the ſorrel, white, and gray; the two laſt for clear waters, the firſt for muddy ones. Nor is the pale watery green deſpiſable; this colour is given artificially, by ſteeping the hair in a liquor made of alum, ſoot, and the juice of walnut leaves, boiled together.

Fishing Rod, a long ſlender rod or wand, to which the line is faſtened, for angling.—Of theſe there are ſeveral ſorts; as, 1. A troller, or trolling rod, which has a ring at the end of the rod, for the line to go through when it runs off a reel. 2. A whipper, or whipping rod; a top rod, that is weak in the middle, and top heavy, but all ſlender and fine. 3. A dropper; which is a ſtrong rod and very light. 4. A ſnapper, or ſnap rod; which is a ſtrong pole, peculiarly uſed for the pike. 5. A bottom rod; being the ſame as the dropper, but ſomewhat more pliable. 6. A ſniggling or procking ſtick; a forked ſtick, having a ſhort ſtrong line, with a needle, baited with a lob worm: this is only for eels in their holes.

Fishing Frog, or *Angler*. See LOPHIUS.

Right of Fishing, and property of fiſh. It has been held, that where the lord of the manor hath the ſoil on both ſides of the river, it is a good evidence that he hath a right of fiſhing; and it puts the proof upon him who claims *liberam piſcariam*: but where a river ebbs and flows, and is an arm of the ſea, there it is common to all, and he who claims a privilege to himſelf muſt prove it; for if the treſpaſs is brought for fiſhing there, the defendant may juſtify, that the place where is *brachium maris, in quo unuſquiſque ſubditus domini regis habet et habere debet liberam piſcariam*. In the Severn the ſoil belongs to the owners of the land on each ſide; and the ſoil of the river Thames is in the king, but the fiſhing is common to all. He who is owner of the ſoil of a private river, hath *ſeparalis piſcaria*; and he that hath *libera piſcaria*, hath a property in the fiſh, and may bring a poſſeſſory action for them; but *communis piſcaria* is like the caſe of all other commons. One that has a cloſe pond in which there are fiſh, may call them *piſces ſuos*, in an indictment, &c. but he cannot call them *bona et catalla*, if they be not in trunks. There needs no privilege to make a fiſh pond, as there doth in the caſe of a warren. See FRANCHISE.

Jacob's Law Dict.

FISSURES, in *Geology*, certain interruptions, that in a horizontal or parallel manner divide the ſeveral ſtrata of which the body of our globe is compoſed. See GEOLOGY *Index*.

Fissure of the Bones, in *Surgery*, is when they are divided either tranſverſely or longitudinally, not quite through, but cracked after the manner of glaſs, by any external force. See SURGERY.

FISTULA, in the ancient muſic, an inſtrument of the wind kind, reſembling our flute or flageolet.

Fiſtula ‖ Fitz-Stephen.

The principal wind inſtruments of the ancients, were the tibia and the fiſtula. But how they were conſtituted, wherein they differed, or how they were played upon, does not appear. All we know is, that the fiſtula was at firſt made of reeds, and afterwards of other matters. Some had holes, ſome none; ſome again were ſingle pipes; others a combination of ſeveral; witneſs the ſyringa of Pan.

FISTULA, in *Surgery*, a deep, narrow, and callous ulcer, generally ariſing from abſceſſes.

It differs from a *ſinus*, in its being callous, the latter not. See SURGERY *Index*.

FISTULA, in *Farriery*. See FARRIERY *Index*.

FISTULARIA, or TOBACCO-PIPE FISH; a genus of fiſhes, belonging to the order of abdominales. See ICHTHYOLOGY *Index*.

FIT. See PAROXYSM.

Dr Cheyne is of opinion, that fits of all kinds, whether epileptic, hyſteric, or apoplectic, may be cured ſolely by milk diet, of about two quarts of cows milk a-day, without any other medicine.

FITCHES, in *Huſbandry*, a ſort of pulſe, more generally known by the name of *chick-pea*. See CICER, BOTANY and AGRICULTURE *Index*.

Fitches are cultivated either for feeding cattle, or improving the land. They make a wholeſome and nouriſhing food, whether given in the ſtraw or thraſhed out. When ſown only to improve the ſoil, they are ploughed in juſt as they begin to bloſſom, by which means a tough ſtiff clay ſoil is much enriched.

FITCHET, a name uſed in ſome places for the weaſel, called alſo the *foumart*. See MUSTELA, MAMMALIA *Index*.

FITCHY, in *Heraldry*, (from the French *fiché*, i. e. *fixed*); a term applied to a croſs when the lower branch ends in a ſharp point: and the reaſon of it Mackenzie ſuppoſes to be, that the primitive Chriſtians were wont to carry croſſes with them wherever they went; and when they ſtopped on their journey at any place, they fixed thoſe portable croſſes in the ground for devotion's ſake.

FITZ, makes part of the ſurname of ſome of the natural ſons of the kings of England, as *Fitz-roy*; which is purely French, and ſignifies the "king's ſon."

FITZHERBERT, SIR ANTHONY, a very learned lawyer in the reign of King Henry VIII. was deſcended from an ancient family, and born at Norbury in Derbyſhire. He was made one of the judges of the court of common pleas in 1523; and diſtinguiſhed himſelf by many valuable works, as well as by ſuch an honourable diſcharge of the duties of his office, as made him eſteemed an oracle of the law. His writings are, *The Grand Abridgement; The Office and Authority of Juſtices of Peace; the Office of Sheriffs, Bailiffs of Liberties, Eſcheators, Conſtables, Coroners, &c.; Of the Diverſity of Courts; The New Natura Brevium*; *Of the Surveying of Lands*, and *The Book of Huſbandry*. He died in 1538.

FITZ-STEPHEN, WILLIAM, a learned monk of Canterbury, of Norman extraction, but born of reſpectable parents in the city of London. He lived in the 12th century; and being attached to the ſervice of Archbiſhop Becket, was preſent at the time of his murder.

In

Fives || Fixlmillner.

In the year 1174, he wrote in Latin, *The Life of St Thomas, archbiſhop and martyr*; in which, as Becket was a native of the metropolis, he introduces a deſcription of the city of London, with a miſcellaneous detail of the manners and uſages of the citizens: this is deſervedly conſidered as a great curioſity, being the earlieſt profeſſed account of London extant. Fitz-Stephen died in 1191.

FIVES, or VIVES. See FARRIERY.

FIXATION, in *Chemiſtry*, the rendering any volatile ſubſtance fixed, ſo as not to fly off upon being expoſed to a great heat: hence,

FIXED BODIES, are thoſe which bear a conſiderable degree of heat without evaporating, or loſing any of their weight. Some of the moſt fixed bodies are diamonds, gold, &c.

FIXED, or *Fixable Air*, an inviſible and permanently elaſtic fluid, ſuperior in gravity to common atmoſpheric air and moſt other aerial fluids, exceedingly deſtructive to animal life; produced in great quantities, naturally from combuſtible bodies, and artificially by many chemical proceſſes. From its acid properties it has obtained the name of *aerial acid*, *cretaceous acid*, and *carbonic acid*; from its noxious qualities, it has been called *mephitic air*; or *mephitic gas*; and, from the circumſtance of being produced in vaſt quantities during the combuſtion of charcoal, it firſt obtained from Van Helmont the name of *gas ſylveſtre*. The term *fixed air* has been given from its property of readily loſing its elaſticity, and fixing itſelf in many bodies, particularly thoſe of the calcareous kind; and though ſome objected to the propriety of the term, the fluid in queſtion is ſo well known by the name of fixed air, that we chooſe ſtill to retain it. See CHEMISTRY *Index*. For an account of the apparatus for impregnating water with fixed air or carbonic acid, ſee MATERIA MEDICA *Index*.

FIXED Stars, are ſuch as conſtantly retain the ſame poſition and diſtance with reſpect to each other; by which they are diſtinguiſhed from *erratic* or *wandering* ſtars, which are continually ſhifting their ſituation and diſtance. The fixed ſtars are properly called *ſtars*; the reſt have the peculiar denomination of *planet* and *comet*. See ASTRONOMY *Index*.

FIXITY, or FIXEDNESS, in *Chemiſtry*, is in a peculiar manner uſed for the affection oppoſite to volatility; i. e. the property whereby bodies bear the action of the fire, without being diſſipated in fumes.

FIXLMILLNER, PLACIDUS, an eminent aſtronomer, was born at Achleiten near Linz, in Auſtria, on the 28th of May, 1720. He received the rudiments of his education in the monaſtery of Kremſmunſter, of which his uncle Alexander was abbot. Here he ſtudied during ſix years, and delighted ſo much in drawing ſtraight and curve-lined figures, that his mother called him the *almanack-maker*. He went afterward to Salzburg, where he ſtudied a regular courſe of philoſophy, and particularly turned his attention to mathematics under a profeſſor Stuard, whoſe method of teaching that ſcience was truly extraordinary, as he never made uſe of any figures, and yet conveyed ſuch a clear idea of every propoſition as made it perfectly eaſy. He was admitted as a novice into Kremſmunſter in 1737, and the next year he took the ſolemn vow in preſence of his uncle. After being two years in this monaſtery, during which time he devoted every leiſure hour to the ſtudy of mathematics and philoſophy, he went to Salzburg to finiſh his ſtudies in divinity and juriſprudence, acquiring at that time a competent knowledge of oriental and modern languages, hiſtory and antiquities. In the year 1745, he obtained the degree of D. D. after which he received prieſt's orders in his own monaſtery, and was created profeſſor of eccleſiaſtical law, which office he held for 40 years, diſcharging the duties belonging to it till within a few days of his death. He was alſo choſen dean of the higher ſchools, and regent of the young nobility, which he retained during life. Fixlmillner

He wrote a commentary on the *Jus Canonicum*, notwithſtanding his extenſive epiſtolary correſpondence, and the management of the whole buſineſs of the monaſtery; but this work was never publiſhed. He was, by the intreaties of his friends, induced to publiſh his *Reipublicæ ſacræ origines divinæ, ſeu Eccleſiæ Chriſti exterior junctura, imperium, et hierarchia, ex primigenia ejus inſtitutione eruta et demonſtrata*. His commendable diligence procured him univerſal eſteem, but it was his knowledge of aſtronomy which rendered him illuſtrious. His uncle Alexander fitted up an apartment for containing the inſtruments neceſſary for the diſſemination of mathematical knowledge, and he alſo erected an obſervatory, which was begun in 1748, and completed in 1758, under the direction of Anſelm Dering of Emſdorf, a celebrated architect. While the obſervatory was building, Fixlmillner led a life of retirement and ſevere ſtudy, his favourite ſubject during theſe ten years being aſtronomy. When it was finiſhed, one Dobler, a celebrated mathematician, was appointed firſt aſtronomer; but the ſucceſſors of Fixlmillner's uncle having diſcovered his extenſive mathematical knowledge, made him an offer of the aſtronomical department, and the ſole direction of the obſervatory. This place he accepted in the year 1762, ſtill retaining his chair as profeſſor of eccleſiaſtical law. He was not yet maſter of the learning which practical aſtronomy requires, to remedy which defect he attentively peruſed Lalande's *Expoſition du Calcul Aſtronomique*, ſoon after which he obtained the large aſtronomical work of the ſame great man, and in 1766 he publiſhed his *Meridianus ſpeculæ Aſtronomicæ Cremifanenſis*, by which he acquired conſiderable reputation. Ten years after this period he gave the world his *Decennium Aſtronomicum*, containing many curious and important particulars reſpecting the theory and practice of aſtronomy. His *Acta Aſtronomica Cremifanenſis*, which did not appear till after his deceaſe, ſtill farther increaſed his aſtronomical reputation; and he was a large contributor to many periodical publications in different countries.

He made and collected a number of obſervations of the planet Mercury, which were at that period both ſcarce and difficult, the importance of which was publicly acknowledged by Lalande, as they greatly aſſiſted him in conſtructing his tables of that planet. Fixlmillner was one of the firſt aſtronomers who calculated the orbit of the new planet Uranus (Georgium Sidus), and his tables reſpecting it may be ſeen in the Berlin almanack for 1789. He alſo proved the truth of what was formerly conjecture, that the 34th ſtar of Taurus, which Flamſtead obſerved in 1690, was the new planet. It may be ſaid of moſt philoſophers, that they obſerve a great

Flaccus, Flag.

great deal, and calculate little, but the conduct of Fixlmillner was exactly the reverſe. He turned his attention to the obſervation of the ſolar ſpots more than any of his predeceſſors, which he noticed in the years 1767, 1776, 1777, 1778, and 1782, from which he deduced important inferences reſpecting the revolution of the ſun on his axis.

He had a genius uncommonly adapted to the ſtudy of mechanics, by which he was enabled to invent a new micrometer, and a machine for grinding concentric circles. As an additional proof of his profound inventive genius, he reſided in the country, by which means he was in a great meaſure deprived of literary aſſiſtance, yet to the very cloſe of life he was a ſingular inſtance of the moſt indefatigable zeal, diligence, and perſeverance. He was little ſubject to the influence of the turbulent paſſions;—perhaps leſs ſo than moſt other men. Like the laws of nature which it was his chief delight to ſtudy, he was ſimple, uniform and conſtant; and ſuch were the mildneſs and integrity of his character, that he could not fail to acquire the love and eſteem of mankind. His high reputation never inſpired him with vanity, and he rather wiſhed to conceal than to propagate what was written in his praiſe. It gave general joy to his monaſtic brethren to celebrate the anniverſary of the fiftieth year of his reſidence in it, which he did not long ſurvive. His health was very much impaired by his intenſe application, and he finiſhed his career on the 27th of Auguſt 1791, in the 71ſt year of his age.

FLACCUS, Caius Valerius, an ancient Latin poet, of whom we have very imperfect accounts remaining. He wrote a poem on the Argonautic expedition; of which, however, he did not live to finiſh the eighth book, dying at about 30 years of age. John Baptiſto Pius, an Italian poet, completed the eighth book of the Argonautics; and added two more from the fourth of Apollonius; which ſupplement was firſt added to Aldus's edition in 1523.

FLAGS, in the army, are ſmall banners of diſtinction ſtuck in the baggage waggons to diſtinguiſh the baggage of one brigade from another; and of one battalion from another; that they may be marſhalled by the waggon-maſter general according to the rank of their brigades, to avoid the confuſion that might otherwiſe ariſe.

Flag, in the marine, a certain banner or ſtandard, by which an admiral is diſtinguiſhed at ſea from the inferior ſhips of his ſquadron; alſo the colours by which one nation is diſtinguiſhed from another. See Plate CCXVIII.

In the Britiſh navy, flags are either red, white, or blue; and are diſplayed from the top of the main-maſt, fore-maſt, or mizen-maſt, according to the rank of the admiral. When a flag is diſplayed from the flag-ſtaff on the main-maſt, the officer diſtinguiſhed thereby is known to be an admiral; when from the fore-maſt, a vice-admiral; and when from the mizen-maſt a rear admiral.

The firſt flag in Great Britain is the royal ſtandard, which is only to be hoiſted when the king or queen are on board the veſſel: the ſecond is that of the anchor of hope, which characterizes the lord high admiral, or lords commiſſioners of the admiralty: and the third is the union flag, in which the croſſes of St George and St Andrew are blended. This laſt is appropriated to the admiral of the fleet, who is the firſt military officer under the lord high admiral.

Flag, Flagellantes.

The next flag after the union is that of the white ſquadron at the main-maſt head; and the laſt, which characterizes an admiral, is the blue, at the ſame maſt head.

For a vice-admiral, the firſt flag is the red, the ſecond the white, the third the blue, at the flag ſtaff on the fore-maſt.

The ſame order proceeds with regard to the rear admirals, whoſe flags are hoiſted on the top of the mizen-maſt: the loweſt flag in our navy is accordingly the blue on the mizen maſt.

To Lower or Strike the Flag, in the marine, is to pull it down upon the cap, or to take it in, out of the reſpect, or ſubmiſſion, due from all ſhips or fleets inferior to thoſe any way juſtly their ſuperiors. To lower or ſtrike the flag in an engagement is a ſign of yielding.

The way of leading a ſhip in triumph is to tie the flags to the ſhrouds, or the gallery, in the hind part of the ſhip and let them hang down towards the water, and to tow the veſſels by the ſtern. Livy relates, that this was the way the Romans uſed thoſe of Carthage.

To Heave out the Flag, is to put out or put abroad the flag.

To Hang out the White Flag, is to aſk quarter; or it ſhows when a veſſel is arrived on a coaſt, that it has no hoſtile intention, but comes to trade, or the like. The red flag is a ſign of defiance and battle.

Flag is alſo uſed for a ſedge, a kind of ruſh.

*Corn-*Flag. See Gladiolus, Botany *Index*.

Sweet-ſcented Flag. See Acorus, Botany *Index*.

Flag-Officers, thoſe who command the ſeveral ſquadrons of a fleet; ſuch are the admirals, vice-admirals, and rear admirals.

The flag officers in our pay, are the admiral, vice-admiral, and rear-admiral, of the white, red, and blue. See Admiral, Flag, and Fleet.

Flag-Ship, a ſhip commanded by a general or flag-officer, who has a right to carry a flag, in contradiſtinction to the ſecondary veſſels under the command thereof.

Flag-Stone, a kind of ſand-ſtone of a flaty ſtructure, on account of which it is much employed for the purpoſe of paving foot paths or the floors of apartments in which wood is unſuitable.

FLAGELLANTES, a ſet of wild fanatics who chaſtiſed and diſciplined themſelves with whips in public.

The ſect of the Flagellantes had its riſe in Italy in the year 1260; its author was one Rainier a hermit; and it was propagated from hence through almoſt all the countries of Europe. It was in all probability no more than the effect of an indiſcreet zeal. A great number of perſons of all ages and ſexes made proceſſions, walking two by two with their ſhoulders bare, which they whipped till the blood ran down, in order to obtain mercy from God, and appeaſe his indignation againſt the wickedneſs of the age. They were then called the *devout*; and having eſtabliſhed a ſuperior, he was called the *general of the devotion*. Though the primitive Flagellantes were exemplary in point of morals,

Flageolet || Flake.

morals, yet they were joined by a turbulent rabble, who were infected with the moſt ridiculous and impious opinions; ſo that the emperors and pontiffs thought proper to put an end to this religious frenzy, by declaring all devout whipping contrary to the divine law, and prejudicial to the ſoul's eternal intereſt.

This ſect revived in Germany towards the middle of the next century, and rambling through many provinces, occaſioned great diſturbances. They held, among other things, that flagellation was of equal virtue with baptiſm and the other ſacraments; that the forgiveneſs of all ſins was to be obtained by it from God without the merits of Jeſus Chriſt; that the old law of Chriſt was ſoon to be aboliſhed, and that a new law enjoining the baptiſm of blood to be adminiſtered by whipping was to be ſubſtituted in its place: upon which Clement VII. by an injudicious as well as unrighteous policy, thundered out anathemas againſt the Flagellantes, who were burnt by the inquiſitors in ſeveral places; but they were not eaſily extirpated. They appeared again in Thuringia and Lower Saxony in the 15th century; and rejected not only the ſacraments, but every branch of external worſhip; and placed their only hopes of ſalvation in faith and flagellation, to which they added other ſtrange doctrines concerning evil ſpirits. Their leader Conrad Schmidt and many others were committed to the flames by German inquiſitors in and after the year 1414.

FLAGEOLET, or FLAJEOLET, a little flute, uſed chiefly by ſhepherds and country people. It is made of box or other hard wood, and ſometimes of ivory; and has ſix holes beſides that at the bottom, the mouth-piece, and that behind the neck.

FLAIL, an inſtrument for thraſhing corn. It conſiſts of the following parts. 1. The hand-ſtaff, or piece held in the thraſher's hand. 2. The ſwiple, or that part which ſtrikes out the corn. 3. The caplins, or ſtrong double leathers, made faſt to the tops of the hand-ſtaff and ſwiple. 4. The middle band, being the leather thong or fiſh ſkin that ties the caplins together.

FLAIR, in ſea language. The ſeamen ſay that the work doth flair over, when a ſhip is houſed in near the water, ſo that the work hangs over a little too much, and this is let out broader aloft than the due proportion will allow.

FLAKE, in the cod fiſhery, a ſort of ſcaffold or platform, made of hurdles, and ſupported by ſtanchions, uſed for drying cod fiſh in Newfoundland. Theſe flakes are uſually placed near the ſhores of fiſhing harbours.

FLAKE, in *Gardening*, a name given by the floriſts to a ſort of carnations which are of two colours only, and have very large ſtripes, all of them going quite through the leaves.

White FLAKE, in *Painting*, is lead corroded by means of the preſſing of grapes, or a ceruſe prepared by the acid of grapes. It is brought from Italy; and far ſurpaſſes, both with regard to the purity of its whiteneſs and the certainty of its ſtanding, all the ceruſe or white lead made with us in common. It is uſed in oil or varniſh painting for all purpoſes where a very clean white is required. The white flake ſhould be procured in lumps as it is brought over, and levigated by thoſe who uſe it; becauſe that which the colourmen ſell in a prepared ſtate is levigated and mixed up with ſtarch, and often with white lead, and worſe ſophiſtications.

Flambeau || Flame.

FLAMBEAU, or FLAMBOY, a luminary made of ſeveral thick wicks, covered over with wax, ſerving to burn at nights in the ſtreets; as alſo at funeral proceſſions, illuminations, &c.

Flambeaux differ from links, torches, and tapers.—They are made ſquare, ſometimes of white wax and ſometimes of yellow. They uſually conſiſt of four wicks or branches near an inch thick, and about three feet long, made of a ſort of coarſe hempen yarn half twiſted. They are made with the ladle much as torches or tapers are; viz. by firſt pouring the melted wax on the top of the ſeveral ſuſpended wicks, and letting it run down to the bottom. This they repeat twice. After each wick has thus got its proper cover of wax, then lay them to dry; then roll them on a table and ſo join four of them together by means of a red hot iron. When joined, they pour on more wax till the flambeau is brought to the ſize required, which is uſually from a pound and half to three pounds. The laſt thing is to finiſh their form or outſide, which they do with a kind of poliſhing inſtrument of wood by running it along all the angles formed by the union of the branches.

The flambeaux of the ancients were different from ours. They were made of woods dried in furnaces or otherwiſe. They uſed divers kinds of wood for this purpoſe; the wood moſt uſual was pine. Pliny ſays, that in his time they frequently alſo burnt oak, elm, and hazel. In the ſeventh book of the *Æneid*, mention is made of a flambeau of pine; and Servius on that paſſage remarks, that they alſo made them of the corneltree.

FLAMBOROUGH HEAD, in *Geography*, a cape or promontory on the eaſtern coaſt of Yorkſhire, five miles eaſt of Burlington, and 216 from London.—E. Long. 20°. N. Lat. 54. 12.—This was the *Fleamburg* of the Saxons; ſo called, as ſome think, from the lights made on it to direct the landing of Ina, who in 547 joined his countrymen in theſe parts with a large reinforcement from Germany, and founded the kingdom of Northumberland. In the time of Edward the Confeſſor, Flamborough was one of the manors of Harold, earl of the Weſt Saxons, afterwards king of England. On his death, the Conqueror gave it to Hugh Lupus; who, in perpetual alms, beſtowed it on the monaſtery of Whitby.—The town is on the north ſide; and conſiſts of about 150 ſmall houſes, entirely inhabited by fiſhermen; few of whom, as is ſaid, die in their beds, but meet their fate in the element they are ſo converſant in. The cliffs of the Head are of a tremendous height and amazing grandeur. Beneath are ſeveral vaſt caverns; ſome cloſed at the end, others pervious, formed with a natural arch. In ſome places the rocks are inſulated, and of a pyramidal figure, ſoaring up to a vaſt height. The baſes of moſt are ſolid, but in ſome pierced through and arched. The colour of all theſe rocks is white, from the dung of the innumerable flocks of migratory birds, which quite cover the face of them, filling every little projection, every hole that will give them leave to reſt.

FLAME, is a general name for every kind of luminous vapour, provided the light it emits hath any conſiderable degree of intenſity. The name *flame*, however,

Flame. ever, is moſt generally applied to ſuch as are of a conical figure, like thoſe ariſing from our common fires; without this, they are commonly called *luminous vapours*, or ſimply *lights*.

According to Sir Iſaac Newton, flame is only *red-hot ſmoke*, or the vapour of any ſubſtance raiſed from it by fire, and heated to ſuch a degree as to emit light copiouſly. This definition ſeems to be the moſt accurate and expreſſive of any. It is certain, that bodies are capable of emitting flame only in proportion to the quantity of vapour that riſes from them. Thus wood, coals, &c. which emit a great quantity of vapour, flame violently; while lead, tin, &c. which emit but a ſmall fume, can ſcarce be perceived to flame at all.

This rule, however, is by no means to be depended upon in all caſes. Some vapours *ſeem* to be in their own nature uninflammable, and capable of extinguiſhing flame; as thoſe of water, the mineral acids, ſal-ammoniac, arſenic, &c.: while others take fire on the ſlighteſt approach of a flaming ſubſtance; ſuch as ether, ſpirit of wine, &c. Theſe laſt mentioned ſubſtances alſo exhibit a remarkable phenomenon; namely, that they cannot be made to flame without the approach of ſome ſubſtance actually in flames beforehand. Thus, ſpirit of wine poured on a red-hot iron, though inſtantly diſſipated in vapour, will not flame; but if a burning candle touches its ſurface, the whole is ſet in a flame at once. The caſe is otherwiſe with oils, eſpecially thoſe of the groſſer kind; for the vapours will readily be changed into flame by the mere increaſe of heat, without the approach of any flaming ſubſtance.

There is, however, no kind of vapour, perhaps, that is incapable of being converted into flame, provided it is expoſed to a ſufficient degree of heat. Thus the vapour of water made to paſs through burning coals produces an exceedingly ſtrong and bright flame.—It is remarkable, that this kind of vapour ſeems to be more powerful than almoſt any other in abſorbing heat, and detaining it in a latent ſtate. When any quantity of aqueous vapour is condenſed, more heat will be ſeparated from it than would have been ſufficient to heat an equal bulk of iron red-hot.—It is moſt probably to this property which all vapours have of abſorbing heat, and detaining it in a latent ſtate, that we are to attribute the phenomena of flame, and alſo the exceeding great elaſticity of ſteam. It is certain, that vapours, of water at leaſt, have a much greater power of abſorbing and retaining heat, than the water from which they are raiſed. In open veſſels, water cannot be heated more than to 212 degrees of Fahrenheit's thermometer; but in Papin's digeſter, where the vapour is forcibly confined, it has been heated to 400 of the ſame degrees; and, no doubt, might have been heated a great deal more, had the veſſels been ſtrong enough to bear the expanſile force of the ſteam. On opening the veſſels, however, the exceſs of heat was found to have reſided entirely in the vapour; for the water in the veſſel very ſoon ſunk down to 212, while the ſteam iſſued forth with great violence.

From theſe experiments it appears, that the ſteam of water, after it has abſorbed as much heat in a latent ſtate as it can contain, continues to abſorb, or detain among its particles, an unlimited quantity of ſenſible heat; and if the ſteam could be confined till this quantity became great enough to be viſible by its emiſſion of light, there cannot be the leaſt doubt that the vapour would then be converted into flame. Flame, Flamen.

In what manner the heat is detained among the particles of ſteam, is perhaps impoſſible to be explained; but to this heat we muſt undoubtedly aſcribe the violent expanſive force of ſteam of every kind. It ſeems probable, that when ſmoke is converted into flame, the latent heat with which the vapour had combined, or rather that which made an eſſential part of it, breaks forth, and adds to the quantity of ſenſible heat which is already preſent. This ſeems probable, from the ſudden exploſion with which all flames break out. If a veſſel full of oil is ſet over the fire, a ſmoke or vapour begins to ariſe from it; which grows gradually thicker and thicker; and at laſt begins to ſhine in ſome places very near the ſurface of the oil, like an electric light, or ſulphur juſt kindled. At this time the oil is very hot, as well as the ſteam which iſſues from it. But this laſt is continually giving off its ſenſible heat into the atmoſphere; ſo that at the diſtance of an inch or two from the ſurface of the oil, the heat of the ſteam will not exceed 400 degrees of Fahrenheit, or perhaps may not be ſo much; but if a burning candle is held in the ſteam for a moment, the whole is immediately converted into flame, with ſomething like an exploſion; after which, the oil burns quietly until it is all conſumed. The flame, as ſoon as it appears, is not only much hotter than the ſteam from whence it was produced, but even than the oil which lies below it. Whence, then, has this ſudden and great increaſe of heat ariſen? It could not be the *ſenſible* heat of the vapour, for that was greatly inferior; nor could it be communicated from the oil, for that could communicate no more than it had to itſelf. The candle, indeed, would communicate a quantity of heat to the vapour which touched its flame; but it is impoſſible that this quantity ſhould extend permanently over a ſurface perhaps 100 times larger than the flame of the candle, in ſuch a manner as to make every part of that ſurface equally hot with the flame of the candle itſelf; for this would be to ſuppoſe it to communicate 100 times more heat than really was in it. The heat therefore muſt have originally reſided in the vapour itſelf; and as, in the freezing of water, its latent heat is extricated and becomes ſenſible, and the water thereupon loſes its fluidity; ſo, in the aſcenſion of vapour, the latent heat breaks forth with a bright flaſh, and the vapour is then totally decompoſed, and converted into ſoot, aſhes, or water, according to the different nature of the ſubſtances which produce it, or according to the intenſity of the heat.—Several other hypotheſes have been invented to ſolve the phenomena of burning and flaming bodies; for an account of which, ſee IGNITION and HEAT, CHEMISTRY *Index*.

Flames are of different colours, according to the ſubſtances from which they are produced. Thus, the flame of ſulphur and ſpirit of wine is blue; the flame of nitre and zinc, of a bright white; that of copper, of a greeniſh blue, &c.—Theſe varieties afford an opportunity of making a number of agreeable repreſentations in fireworks, which could not be done if the flame produced from every different ſubſtance was of the ſame colour. See PYROTECHNICS.

FLAMEN, in Roman antiquity, the name of an order

Flamen Flaminius.

order of prieſts, inſtituted by Romulus or Numa; authors not being agreed on this head.

They were originally only three, viz. the *Flamen Dialis*, *Flamen Martialis*, and *Flamen Quirinalis*. The Flamen Dialis was ſacred to Jupiter, and a perſon of the higheſt conſequence and authority in the ſtate. He diſcharged ſeveral religious duties which properly belonged to the kings, and was honoured with many eminent privileges beyond all other officers, but was obliged to obſerve ſeveral ſuperſtitious reſtraints. The Flamen Martialis was ſacred to Mars, and was ordained to inſpect the rites of that god. The Flamen Quirinalis was ſacred to, and ſuperintended the rites of, Quirinus Romulus. The Flamines laſt mentioned, though of high authority, were much inferior to the Flamen Dialis. All three were choſen by the people, and conſecrated by the Pontifex Maximus.—In latter times ſeveral prieſts of the ſame order and name were added to them, but inferior in power. The whole number at laſt amounted to 15: the three firſt of whom were ſenators, and called *Flamines majores*; the other 12, taken from among the people, being denominated *Flamines minores*.—Some authors tell us the Romans had a Flamen for every deity they worſhipped. The greater Flamines wore the robe edged with purple, like the great magiſtrates; had an ivory chair, and a ſeat in the ſenate. They wore a little band of thread about their heads, whence their name is ſaid to be derived, *quaſi Filamines*.—The wife of the Flamen Dialis was called *Flaminica*, and wore a flame-coloured habit, on which was painted a thunderbolt, and above her head-dreſs ſhe had green oak boughs, to indicate that ſhe belonged to Jupiter the thunderer, to whom the oak was ſacred. The Flamines wore each of them a hat or cap called *Flammeum* or *Apex*.

FLAMINGO, in *Ornithology*. See PHOENICOPTERUS, ORNITHOLOGY *Index*.

FLAMINIUS, or FLAMININUS, T. Q. a celebrated Roman, raiſed to the conſulſhip in the year of Rome 554, though under the age of 30. He was trained in the art of war againſt Hannibal; and he ſhowed himſelf capable in every reſpect to diſcharge with honour the great office with which he was intruſted. He was ſent at the head of the Roman troops againſt Philip king of Macedon, and in his expedition he met with uncommon ſucceſs. The Grecks gradually declared themſelves his firmeſt ſupporters; and he totally defeated Philip on the confines of Epirus, and made all Locris, Phocis, and Theſſaly, tributary to the Roman power. He granted peace to the conquered monarch, and proclaimed all Greece free and independent at the Iſthmian games. This celebrated action procured the name of Patrons of Greece to the Romans, and inſenſibly paved their way to univerſal dominion. Flaminius behaved among them with the greateſt policy; by his ready compliance to their national cuſtoms and prejudices, he gained uncommon popularity, and received the name of father and deliverer of Greece. He was afterwards ſent ambaſſador to King Pruſias, who had given refuge to Hannibal; and there his prudence and artifice haſtened out of the world a man who had long been the terror of the Romans. Flaminius was found dead in his bed, after a life ſpent in the greateſt glory, in which he had imitated with ſucceſs the virtues of his model Scipio.

Flaminius Flamſteed.

FLAMINIUS or FLAMINIO, *Mark Antony*, one of the beſt Latin poets in the 16th century, of Imola in Italy, ſon and grandſon of very learned men. The pope had choſen him ſecretary to the council in 1545; but he refuſed that employment, becauſe, favouring the new opinions, he would not employ his pen in an aſſembly where he knew theſe opinions were to be condemned.—He paraphraſed 38 of the pſalms in Latin verſe, and alſo wrote notes on the Pſalms; and ſome letters and poems which are eſteemed. He died at Rome in 1550.

FLAMSTED, a town of Hertfordſhire in England, five miles from St Albans and Dunſtable, ſtands on the river Verlam and was of old called Verlamſtede. The land in the vicinity is a clay ſo thickly mixed with flints, that, after a ſhower, nothing appears but a heap of ſtones; and yet it bears good corn even in dry ſummers. This fertility is imputed to a warmth in the flint, which preſerves it from cold in the winter; and to its cloſeneſs, which keeps it from the ſcorching rays of the ſun in the ſummer. Edward VI. when an infant, was brought hither for his health; and, it is ſaid, the bedſtead he lay on, which is curiouſly wrought, is ſtill preſerved in the manor houſe near the town.

FLAMSTEED, JOHN, an eminent Engliſh aſtronomer, and the firſt who obtained the appointment of aſtronomer-royal, was born at Derby in the year 1646. He was educated at the free ſchool of Derby, where he was head ſcholar at 14 years of age, at which period his conſtitution, naturally tender and delicate, was much tried by a ſevere illneſs. When ſome of his companions went to the univerſity, the ſtate of his health prevented him from accompanying them. He afterwards met with a book *De Sphæra*, written by John Sacroboſco, which was perfectly ſuited to the natural turn of his genius, and therefore he peruſed it with uncommon ſatisfaction, tranſlating as much of it into Engliſh as he thought would be neceſſary for him; and from the *Aſtronomia Carolinæ* of Strut he learned the method of calculating eclipſes, and aſcertaining the places of the planets. Mr Hatton, a mathematician, ſent him Kepler's *Tabulæ Rudolphinæ*, and *Riccioli's Almageſtum Novum*, together with ſome other aſtronomical works to which he was as yet a ſtranger. In 1669 he calculated an eclipſe of the ſun, which had been omitted in the Ephemerides for the following year, together with five appulſes of the moon to fixed ſtars, and ſent them to Lord Brouncker, preſident of the Royal Society, who ſubmitted them to the examination of that learned body, by which they were greatly applauded, and he received a letter of thanks from Mr Oldenburg the ſecretary. He likewiſe received a letter of thanks from Mr Collins, one of the members. In 1670 he was invited to come up to London by his father, that he might become perſonally acquainted with his learned correſpondents, of which he gladly accepted, and had an interview with Mr Oldenburg and Mr Collins, by the latter of whom he was introduced to Sir Jonas Moore, who became the warm friend and patron of Mr Flamſteed. In conſequence of this journey he became acquainted with many aſtronomical inſtruments, and was preſented by Sir Jonas Moore with Townley's micrometer, who alſo aſſiſted him in procuring glaſſes at a moderate rate for the conſtruction of teleſcopes. On his way home again he returned by Cambridge, where he paid a viſit to the celebrated Dr Barrow

Flamſteed, Flanders.

Barrow and Sir Iſaac, then Mr Newton, and entered a ſtudent of Jeſus college.

In the year 1672, he made large extracts from the letters of Gaſcoigne and Crabtree, by which his knowledge of dioptrics was very much improved; and during the ſame year he made a number of celeſtial obſervations when the weather would permit, which were afterwards publiſhed in the Philoſophical Tranſactions. In 1673 he compoſed a treatiſe on the true and apparent diameters of the planets, when at their greateſt and leaſt diſtance from the earth, which even the great Newton did not ſcruple to borrow, and made ſome uſe of it in his Principia in 1685. He publiſhed an Ephemeris in 1674, in which he expoſed the folly and abſurdity of aſtrology, and the ſame year he drew up a table of the tides for the uſe of the king, with an aſtronomical account of their ebbing and flowing, which Sir Jonas Moore aſſured him would be well received by his majeſty. Sir Jonas received from Mr Flamſteed a pair of barometers, with directions how to uſe them, which he preſented to the king and the duke of York, to whoſe notice he embraced every opportunity of introducing Mr Flamſteed.

Having taken the degree of M. A. at Cambridge, he formed the reſolution of entering into holy orders, when Sir Jonas wrote to him to come to London, where he had an appointment for him very different from that of the church. But as he found that nothing could make him abandon the reſolution he had formed, he obtained a ſituation for him which was perfectly conſiſtent with the character of a clergyman. This was the new office of aſtronomer to the king, with a ſalary of 100l. per annum. He received ordination at Ely-houſe by Biſhop Gunning, in Eaſter 1675; and on the 10th of Auguſt in the ſame year the foundation ſtone of the royal obſervatory at Greenwich was laid, which received the deſignation of Flamſteed houſe, in honour of the firſt aſtronomer royal. Till this edifice was erected, he made his obſervations in the queen's houſe at Greenwich, and in 1681 his Doctrine of the Sphere was publiſhed by Sir Jonas Moore in his ſyſtem of the mathematics. Notwithſtanding his extraordinary merit, he never roſe higher in the church than to the living of Burſlow in Surrey, although he was deſervedly eſteemed by the greateſt men in the nation. He correſponded with the great Newton, Dr Halley, Mr W. Molyneux, Dr Wallis, and many others; and M. Caſſini and he imparted their diſcoveries to each other with the utmoſt confidence and cordiality. But none of his works contributed ſo much to render his fame immortal as his "Hiſtoria Cæleſtis Britannica," in three volumes folio. Mr Flamſteed was ſuddenly carried off by a ſtrangury on the 31ſt of December 1719; and notwithſtanding the extreme delicacy of his conſtitution and inceſſant labours, he reached the 73d year of his age.

FLANDERS, a province of the Netherlands, bounded by the German ſea and the United Provinces on the north, by the province of Brabant on the eaſt, by Hainault and Artois on the ſouth, and by another part of Artois and the German ſea on the weſt; being about 60 miles long and 50 broad.

Flanders is a perfectly champaign country, with not a riſing ground or hill in it, and watered with many fine rivers and canals. Its chief commodities are fine lace, linen, and tapeſtry. Flanel.

In this country ſome important arts were invented and improved. Weaving in general was greatly improved, and that of figures of all ſorts in linen was invented; alſo the art of dycing cloths and ſtuffs, and of oil colours; the curing of herrings, &c. The manufactures of this country are not now in the flouriſhing ſtate they were formerly; yet ſilk, cotton, and woollen ſtuffs, brocades, camblets, tapeſtry, lace, and linen, are ſtill manufactured here in great quantities. This province had counts of its own from the ninth century to the year 1369, when it went by marriage to the dukes of Burgundy; and afterwards from them, by marriage alſo, to the houſe of Auſtria. France, in 1667, ſeized the ſouthern part; and the ſtates general obtained the northern, partly by the treaty of Munſter, and partly by the barrier treaty of 1715.

For a more particular hiſtory of Flanders, with a continuation down to the preſent times, ſee the article NETHERLANDS.

FLANEL, or FLANNEL, a kind of ſlight, looſe, woollen ſtuff, compoſed of a woof and warp, and wove on a loom with two treddles, after the manner of baize.

Dr Black aſſigns as a reaſon why flanel and other ſubſtances of the kind keep the body warm, that they compoſe a rare and ſpongy maſs, the fibres of which touch each other ſo ſlightly, that the heat moves ſlowly through the interſtices, which being filled only with air, and that in a ſtagnant ſtate, give little aſſiſtance in conducting the heat. From the experiments of Count Rumford, it appears, that there is a relation betwixt the power which the ſubſtances uſually worn as clothing have of abſorbing moiſture, and that of keeping the body warm. Having provided a quantity of each of theſe ſubſtances mentioned below, he expoſed them, ſpread out upon clean China plates, for the ſpace of 24 hours to the warm and dry air of a room which had been heated by a German ſtove for ſeveral months, and during the laſt ſix hours had raiſed the thermometer to 85° of Fahrenheit; after which he weighed equal quantities of the different ſubſtances with a very accurate balance. They were then ſpread out upon a China plate, and removed into a very large uninhabited room upon the ſecond floor, where they were expoſed 48 hours upon a table placed in the middle of the room, the air of which was at 45° of Fahrenheit. At the end of this ſpace they were weighed, and then removed into a damp cellar, and placed on a table in the middle of the vault, where the air was at the temperature of 45°, and which by the hygrometer ſeemed to be fully ſaturated with moiſture. In this ſituation they were ſuffered to remain three days and three nights; the vault being all the time hung round with wet linen cloths, to render the air as completely damp as poſſible. At the end of three days they were weighed, and the weights at the different times were found as in the following table.

Flanel.

		Weight after being dried in the hot room.	Weight after coming out of the cold room.	Weight after remaining 72 h. in the vault.
Sheep's wool		Parts 1000	1084	1163
Beaver's fur			1072	1125
The fur of a Ruſſian hare			1065	1115
Eider down			1067	1112
Silk	Raw ſingle thread		1057	1107
	Ravellings of white taffety		1054	1103
Linen	Fine lint		1046	1102
	Ravelling of fine linen		1044	1082
Cotton wool			1043	1089
Ravellings of ſilver lace			1000	1000

On theſe experiments our author obſerves, that though linen, from the apparent eaſe with which it receives dampneſs from the atmoſphere, ſeems to have a much greater attraction for water than any other; yet it would appear from what is related above, that thoſe bodies which receive water in its unelaſtic form with the greateſt eaſe, or are moſt eaſily wet, are not thoſe which in all caſes attract the moiſture of the atmoſphere with the greateſt avidity. "Perhaps (ſays he), the apparent dampneſs of linen to the touch, ariſes more from the eaſe with which that ſubſtance parts with the water it contains, than from the quantity of water it actually holds: in the ſame manner as a body appears hot to the touch, in conſequence of its parting freely with its heat; while another body which is really at the ſame temperature, but which withholds its heat with great obſtinacy, affects the ſenſe of feeling much leſs violently. It is well known that woollen clothes, ſuch as flanels, &c. worn next the ſkin, greatly promote inſenſible perſpiration. May not this ariſe principally from the ſtrong attraction which ſubſiſts between wool and the watery vapour which is continually iſſuing from the human body? That it does not depend entirely on the warmth of that covering, is clear; for the ſame degree of warmth produced by wearing more clothing of a different kind, does not produce the ſame effect. The perſpiration of the human body being abſorbed by a covering of flanel, it is immediately diſtributed through the whole thickneſs of that ſubſtance, and by that means expoſed, by a very large ſurface, to be carried off by the atmoſphere; and the loſs of this watery vapour which the flanel ſuſtains on the one ſide by evaporation, being immediately reſtored from the other, in conſequence of the ſtrong attraction between the flanel and this vapour, the pores of the ſkin are diſencumbered, and they are continually ſurrounded by a dry and ſalubrious atmoſphere."

Our author expreſſes his ſurpriſe, that the cuſtom of wearing flanel next the ſkin ſhould not have prevailed more univerſally. He is confident it would prevent a number of diſeaſes; and he thinks there is no greater luxury than the comfortable ſenſation which ariſes from wearing it, eſpecially after one is a little accuſtomed to it. "It is a miſtaken notion (ſays he), that it is too warm a clothing for ſummer. I have worn it in the hotteſt climates, and at all ſeaſons of the year; and never found the leaſt inconvenience from it. It is the warm bath of perſpiration confined by a linen ſhirt, wet with ſweat, which renders the ſummer heats of ſouthern climates ſo unſupportable; but flanel promotes perſpiration, and favours its evaporation; and evaporation, as is well known, produces poſitive cold.

Flank || Flats.

It has been obſerved that new flanel, after ſome time wearing, acquires the property of ſhining in the dark, but loſes it on being waſhed. *Philoſophical Tranſactions*, N° 483. § 7.

FLANK, or FLANC, in the manege, is applied to the ſides of a horſe's buttocks, &c. In a ſtrict ſenſe, the flanks of a horſe are the extremes of the belly, where the ribs are wanting, and are below the loins.

The flanks of a horſe ſhould be full, and at the top of each a feather. The diſtance between the laſt rib and hauch-bone, which is properly the flank, ſhould be ſhort, which they term *well coupled*, ſuch horſes being moſt hardy, and fit to endure labour.

A horſe is ſaid to have no flank if the laſt of the ſhort ribs be at a conſiderable diſtance from the haunch-bone; as alſo when the ribs are too much ſtraitened in their compaſs.

FLANK, in *War*, is uſed by way of analogy for the ſide of a battalion, army, &c. in contradiſtinction to the *front* and *rear*.

To attack the enemy in flank, is to diſcover and fire upon them on the ſide. See FILE.

FLANK, in *Fortification*, is a line drawn from the extremity of the face towards the inſide of the work.

Or, flank is that part of a baſtion which reaches from the curtain to the face, and defends the oppoſite face, the flank, and the curtain. See FORTIFICATION.

Oblique or *Second* FLANK, or FLANK *of the Curtain*, is that part of the curtain from whence the face of the oppoſite baſtion can be ſeen, being contained between the lines raſant and fichant, or the greater and leſs lines of defence; or the part of the curtain between the flank and the point where the fichant line of defence terminates.

Covered, *Low*, or *Retired* FLANK, is the platform of the caſement, which lies hid in the baſtion; and is otherwiſe called the Orillon.

Fichant FLANK, is that from whence a cannon playing, fires directly on the face of the oppoſite baſtion.

Raſant or *Razant* FLANK, is the point from whence the line of defence begins, from the conjunction of which with the curtain, the ſhot only raſeth the face of the next baſtion, which happens when the face cannot be diſcovered but from the flank alone.

FLAT, in ſea-language, denotes a level ground lying at a ſmall depth under the ſurface of the ſea, and is alſo called a *ſhoal* or *ſhallow*.

FLAT-bottomed Boats are ſuch as are made to ſwim in ſhallow water, and to carry a great number of troops, artillery, ammunition, &c. They are conſtructed with a 12 pounder, bow-chaſe, and an 18 pounder, ſtern-chaſe; their keel is from 90 to 100 feet, and from 12 to 24 feet beam: they have one maſt, a large ſquare main-ſail, and a jib-ſail; are rowed by 18 or 20 oars, and can carry 400 men each. The gun takes up one bow, and a bridge the other, over which the troops are to march. Thoſe that carry horſes have the fore-part of the boat made to open when the men are to mount and ride over a bridge.

FLATS, in *Muſic*. See INTERVAL.

FLATUS,

Flatus || Flax.

FLATUS, FLATULENCE, in *Medicine*; vapours generated in the ſtomach and inteſtines, chiefly occaſioned by a weakneſs of theſe parts. They occaſion diſtenſions, uneaſy ſenſation, and ſickneſs, and often a conſiderable degree of pain. See MEDICINE *Index*.

FLAVEL, JOHN, an eminent non-conformiſt miniſter, was educated at Univerſity-college, in Oxford; and became miniſter firſt of Deptford, and afterwards of Dartmouth in Devonſhire, where he reſided the greateſt part of his life, much reſpected and admired for his preaching; although he was perſecuted on account of his principles, when in 1685, ſeveral of the aldermen of the town, attended by the rabble, carried about a ridiculous effigy of him, to which were affixed the Bill of Excluſion and the Covenant. Upon this occaſion, he thought it prudent to withdraw from the town; not knowing what treatment he might meet with from a riotous mob, headed by magiſtrates who were themſelves among the loweſt of mankind. Part of his Diary, printed with his Remains, muſt give the reader a high idea of his piety. He died in 1691, aged 61; and after his death, his works, which conſiſted of many pieces of practical divinity, were printed in two volumes folio. Among theſe, the moſt famous are his "Navigation Spiritualized, or a New Compaſs for Seamen, conſiſting of 32 points of pleaſant obſervations and ſerious reflections," of which there have been ſeveral editions in 8vo; and his "Huſbandry Spiritualized, &c. with occaſional meditations upon beaſts, birds, trees, flowers, rivers and ſeveral other objects," of which alſo there have been many editions in octavo.

FLAX, in *Botany*. See LINUM, BOTANY *Index*.

The following particulars with regard to the manner of raiſing flax, have been ſome years paſt warmly recommended by the truſtees for fiſheries, manufactures, and improvements in Scotland.

Of the choice of the Soil, and preparing the Ground for FLAX. A ſkilful flax-raiſer always prefers a free open deep loam; and all grounds that produced the preceding year a good crop of turnip, cabbage, potatoes, barley, or broad clover, or have been formerly laid down rich, and kept for ſome years in paſture.

A clay ſoil, the ſecond or third crop after being limed, will anſwer well for flax; provided, if the ground be ſtill ſtiff, that it be brought to a proper mould, by tilling after harveſt to expoſe it to the winter froſts.

All new grounds produce a ſtrong crop of flax, and pretty free of weeds. When a great many mole heaps appear upon new ground, it anſwers the better for flax, after one tilling.

Flax ſeed ought never to be ſown on grounds that are either too wet or dry; but on ſuch as retain a natural moiſture: and ſuch grounds as are inclined to weeds ought to be avoided, unleſs prepared by a careful ſummer fallow.

If the linſeed be ſown early, and the flax not allowed to ſtand for ſeed, a crop of turnip may be got after the flax that very year; the ſecond year a crop of bear or barley may be taken; and the third year, graſs ſeeds are ſometimes ſown along with the linſeed. This is the method moſtly practiſed in and about the counties of Lincoln and Somerſet, where great quantities of flax and hemp are every year raiſed, and where theſe crops have long been capital articles. There, old ploughed grounds are never ſown with linſeed, unleſs the ſoil be very rich and clean. A certain worm, called in Scotland the *coup worm*, abounds in grounds newly broken up, and greatly hurts every crop but flax. In ſmall encloſures ſurrounded with trees or high hedges, the flax, for want of free air, is ſubject to fall before it be ripe; and the droppings of rain and dew from the trees prevent the flax, within the reach of the trees, from growing to any perfection. Flax

Of preceding crops, potatoes and hemp are the beſt preparation for flax. In the fens of Lincoln, upon proper ground of old tillage, they ſow hemp, dunging well the firſt year; the ſecond year, hemp without dung; the third year, flax without dung; and that ſame year, a crop of turnip eaten on the ground by ſheep; the fourth year, hemp with a large coat of dung; and ſo on for ever.

If the ground be free and open, it ſhould be but once ploughed; and that as ſhallow as poſſible, not deeper than 2½ inches. It ſhould be laid flat, reduced to a fine garden mould by much harrowing, and all ſtones and ſods ſhould be carried off.

Except a little pigeons dung for cold or ſour ground, no other dung ſhould be uſed preparatory for flax; becauſe it produces too many weeds, and throws up the flax thin and poor upon the ſtalk.

Before ſowing, the bulky clods ſhould be broken, or carried off the ground; and ſtones, quickenings, and every other thing that may hinder the growth of the flax ſhould be removed.

Of the choice of Linſeed. The brighter in colour, and heavier the ſeed is, ſo much the better; that which when bruiſed appears of a light or yellowiſh green, and freſh in the heart, oily and not dry, and ſmells and taſtes ſweet, and not fuſty, may be depended upon.

Dutch ſeed of the preceding year's growth, for the moſt part, anſwers beſt; but it ſeldom ſucceeds if kept another year. It ripens ſooner than any other foreign ſeed. Philadelphia ſeed produces fine lint and few bolls, becauſe ſown thick, and anſwers beſt in wet cold ſoils. Riga ſeed produces coarſer lint, and the greateſt quantity of ſeed. Scots ſeed, when well winned and kept, and changed from one kind of ſoil to another, ſometimes anſwers pretty well; but ſhould be ſown thick, as many of its grains are bad, and fail. It ſprings well, and its flax is ſooner ripe than any other; but its produce afterwards is generally inferior to that from foreign ſeed.

A kind has been lately imported called *Memmel ſeed*; which looks well, is ſhort and plump, but ſeldom grows above eight inches, and on that account ought not to be ſown.

Of Sowing Linſeed. The quantity of linſeed ſown ſhould be proportioned to the condition of the ſoil; for if the ground be in good heart, and the ſeed ſown thick, the crop will be in danger of falling before it is ready for pulling. From 11 to 12 pecks Linlithgow meaſure of Dutch or Riga ſeed, is generally ſufficient for one Scots acre; and about 10 pecks of Philadelphia ſeed, which, being the ſmalleſt grained, goes fartheſt. Riga linſeed, and the next year's produce of it, is preferred in Lincolnſhire.

The time for ſowing linſeed is from the middle of March to the end of April, as the ground and ſeaſon anſwers;

Flax. anſwers; but the earlier the ſeed is ſown, the leſs the crop interferes with the corn harveſt.

Late ſown linſeed may grow long, but the flax upon the ſtalk will be thin and poor.

After ſowing, the ground ought to be harrowed till the ſeed is well covered, and then (ſuppoſing the ſoil, as before mentioned, to be free and reduced to a fine mould) it ought to be rolled.

When a farmer ſows a large quantity of linſeed, he may find it proper to ſow a part earlier and part later, that in the future operations of weeding, pulling, watering, and graſſing, the work may be the eaſier and more conveniently gone about.

It ought always to be ſown on a dry bed.

Of Weeding FLAX. It ought to be weeded when the crop is about four inches long. If longer deferred, the weeders will ſo much break and crook the ſtalks, that they will never perhaps recover their ſtraightneſs again; and when the flax grows crooked, it is more liable to be hurt in the rippling and ſwingling.

Quicken graſs ſhould not be taken up; for, being ſtrongly rooted, the pulling of it always looſens a deal of the lint.

If there is an appearance of a ſettled drought, it is better to defer the weeding, than by that operation to expoſe the tender roots of the flax to the drought.

How ſoon the weeds are got out, they ought to be carried off the field, inſtead of being laid in the furrows, where they often take root again, and at any rate obſtruct the growth of the flax in the furrows.

Of Pulling FLAX. When the crop grows ſo ſhort and branchy, as to appear more valuable for ſeed than flax, it ought not to be pulled before it be thoroughly ripe; but if it grows long and not branchy, the ſeed ſhould be diſregarded, and all the attention given to the flax. In the laſt caſe it ought to be pulled after the bloom has fallen, when the ſtalk begins to turn yellow, and before the leaves fall, and the bolls turn hard and ſharp pointed.

When the ſtalk is ſmall, and carries few bolls, the flax is fine; but the ſtalk of coarſe flax is groſs, rank, branchy, and carries many bolls.

When the flax has fallen, and lies, ſuch as lies ought to be immediately pulled, whether it has grown enough or not, as otherwiſe it will rot altogether.

When parts of the ſame field grow unequally, ſo that ſome parts are ready for pulling before other parts; only what is ready ſhould be pulled, and the reſt ſhould be ſuffered to ſtand till ready.

The flax-raiſer ought to be at pains to pull and keep by itſelf, each different kind of lint which he finds in his field; what is both long and fine, by itſelf; what is both long and coarſe, by itſelf; what is both ſhort and fine, by itſelf; what is both ſhort and coarſe, by itſelf; and in like manner every other kind by itſelf that is of the ſame ſize and quality. If the different kinds be not thus kept ſeparate, the flax muſt be much damaged in the watering and the other ſucceeding operations.

What is commonly called *under-growth* may be neglected as uſeleſs.

Few perſons that have ſeen pulled flax, are ignorant of the method of laying it in handfuls acroſs each other; which gives the flax ſufficient air, and keeps the handfuls ſeparate and ready for the rippler. Flax.

Of Stacking up FLAX *during the Winter, and Winning the Seed.* If the flax be more valuable than the ſeed, it ought by no means to be ſtacked up; for its own natural juice aſſiſts it greatly in the watering; whereas, if kept long unwatered, it loſes that juice, and the harle adheres ſo much to the boon, that it requires longer time to water, and even the quality of the flax becomes thereby harſher and coarſer. Beſides, the flax ſtacked up over year, is in great danger from vermine and other accidents; the water in ſpring is not ſo ſoft and warm as in harveſt; and near a year is thereby loſt of the uſe of the lint: but if the flax be ſo ſhort and branchy as to appear moſt valuable for ſeed, it ought, after pulling, to be ſtooked and dried upon the field, as is done with corn; then ſtacked up for winter, rippled in ſpring; and after ſheeling, the ſeed ſhould be well cleaned from bad ſeeds, &c.

Of Rippling FLAX. After pulling, if the flax is to be regarded more than the ſeed, it ſhould be allowed to lie ſome hours upon the ground to dry a little, and ſo gain ſome firmneſs, to prevent the ſkin or harle, which is the flax, from rubbing off in the rippling; an operation which ought by no means to be neglected, as the bolls, if put into the water along with the flax, breed vermine there, and otherwiſe ſpoil the water. The bolls alſo prove very inconvenient in the graſſing and breaking.

In Lincolnſhire and Ireland, they think that rippling hurts the flax; and therefore, in place of rippling, they ſtrike the bolls againſt a ſtone.

The handfuls for rippling ſhould not be great, as that endangers the lint in the rippling comb.

After rippling, the flax-raiſer will perceive, that he is able to aſſort each ſize and quality of the flax by itſelf more exactly than he could before.

Of Watering FLAX. A running ſtream waſtes the lint, makes it white, and frequently carries it away. Lochs, by the great quantity and motion of the water, alſo waſte and whiten the flax, though not ſo much as running ſtreams. Both rivers and lochs water the flax quicker than canals.

But all flax ought to be watered in canals, which ſhould be digged in clay ground if poſſible, as that ſoil retains the water beſt: but if a firm retentive ſoil cannot be got, the bottom or ſides of the canal, or both the bottom and ſides, may be lined with clay; or inſtead of lining the ſides with clay, which might fall down, a ditch may be dug without the canal, and filled with clay, which will prevent both extraneous water from entering, and the water within from running off.

A canal of 40 feet long, ſix broad, and four deep, will generally water the growth of an acre of flax.

It ought to be filled with freſh ſoft water from a river or brook, if poſſible, two or three weeks before the flax is put in, and expoſed all that time to the heat of the ſun. The greater way the river or brook has run, the ſofter, and therefore the better, will the water be. Springs, or ſhort runs from hills, are too cold, unleſs the water is allowed to ſtand long in the canal. Water from coal or iron is very bad for flax. A little of the powder of galls thrown into a glaſs of water,

Flax. will immediately discover if it comes from minerals of that kind, by turning it into a dark colour, more or less tinged in proportion to the quantity of vitriol it contains.

The canal ought not to be under shade: which, besides keeping the sun from softening the water, might make part of the canal cooler than other parts, and so water the flax unequally.

The flax-raiser will observe, when the water is brought to a proper heat, that small plants will be rising quickly in it, numbers of small insects and reptiles will be generating there, and bubbles of air rising on the surface. If no such signs appear, the water must not be warm enough, or is otherwise unfit for flax.

Moss holes, when neither too deep nor too shallow, frequently answer well for watering flax, when the water is proper, as before described.

The proper season for watering flax is from the end of July to the end of August.

The advantage of watering flax as soon as possible after pulling, has been already mentioned.

The flax being sorted after rippling, as before mentioned, should next be put in beets, never larger than a man can grasp with both his hands, and tied very slack with a band of a few stalks. Dried rushes answer exceedingly well for binding flax, as they do not rot in the water, and may be dried and kept for use again.

The beets should be put into the canals slopewise, or half standing upon end, the root end uppermost. Upon the crop ends, when uppermost, there frequently breeds a deal of vermine, destructive of the flax, which is effectually prevented by putting the crop end downmost.

The whole flax in the canal ought to be carefully covered from the sun with divots; the grassy side of which should be next the flax, to keep it clean. If it is not thus covered, the sun will discolour the flax, though quite covered with water. If the divots are not weighty enough to keep the flax entirely under water, a few stones may be laid above them. But the flax should not be pressed to the bottom.

When the flax is sufficiently watered, it feels soft to the gripe, and the *harle* parts easily with the *boon* or *show*, which last is then become brittle, and looks whitish. When these signs are found, the flax should be taken out of the water, beet after beet; each gently rinsed in the water, to cleanse it of the nastiness which has gathered about it in the canal; and as the lint is then very tender, and the beet slackly tied, it must be carefully and gently handled.

Great care ought to be taken that no part be overdone; and as the coarsest waters soonest, if different kinds be mixed together, a part will be rotted, when the rest is not sufficiently watered.

When lint taken out of the canal is not found sufficiently watered, it may be laid in a heap for 12, 18, or 24 hours, which will have an effect like more watering; but this operation is nice, and may prove dangerous in unskilful hands.

After the flax is taken out of the canal, fresh lint should not be put a second time into it, until the former water be run off, and the canal cleaned, and supplied with fresh water.

Of Grassing Flax. Short heath is the best field for grassing flax; as, when wet, it fastens to the heath, and is thereby prevented from being blown away by the wind. The heath also keeps it a little above the earth, and so exposes it the more equally to the weather. When such heath is not to be got, links or clean old lea ground is the next best. Long grass grounds should be avoided, as the grass growing through the lint frequently spots, tenders, or rots it; and grounds exposed to violent winds should also be avoided. Flax.

The flax, when taken out of the water, must be spread very thin upon the ground; and being then very tender, it must be gently handled. The thinner it is spread the better, as it is then the more equally exposed to the weather. But it ought never to be spread during a heavy shower, as that would wash and waste the harle too much, which is then excessively tender, but soon after becomes firm enough to bear the rains, which, with the open air and sunshine, cleans, softens, and purifies the harle to the degree wanted, and makes it blister from the boon. In short, after the flax has got a little firmness by being a few hours spread in dry weather, the more rain and sunshine it gets the better.

If there be little danger of high winds carrying off the flax, it will be much the better of being turned about once a week. If it is not to be turned, it ought to be very thin spread. The spreading of flax and hemp requires a deal of ground, and enriches it greatly.

The skilful flax-raiser spreads his first row of flax at the end of the field opposite to the point from whence the most violent wind commonly comes, placing the root-ends foremost; he makes the root-ends of every other row overlap the crop ends of the former row three or four inches, and binds down the last row with a rope; by which means the wind does not easily get below the lint to blow it away; and as the crop ends are seldom so fully watered as the root ends, the aforesaid overlapping has an effect like giving the crop ends more watering. Experience only can fully teach a person the signs of flax being sufficiently grassed: then it is of a clearer colour than formerly; the harle is blistered up, and easily parts with the boon, which is then become very brittle. The whole should be sufficiently grassed before any of it is lifted; for if a part be lifted sooner than the rest, that which remains is in great danger from the winds.

A dry day ought to be chosen for taking up the flax; and if there is no appearance of high wind, it should be loosed from the heath or grass, and left loose for some hours, to make it thoroughly dry.

As a great quantity of flax can scarcely be all equally watered and grassed, and as the different qualities will best appear at lifting the flax off the grass; therefore at that time each different kind should be gathered together, and kept by itself; that is, all of the same colour, length, and quality.

The smaller the beets lint is made up in, the better for drying, and the more convenient for stacking, housing, &c. and in making up these beets, as in every other operation upon flax, it is of great consequence that the lint be laid together as it grew, the root ends together, and the crop ends together.

Flowers

Flax. Flax.

Follows an eſtimate of the Expence, Produce, and Profit of a Scots Acre of Flax,—*ſuppoſing the ſeaſon favourable, that no accidental loſſes happen, and that the farmer is neither unſkilful nor negligent.*

	A medium crop.	*A great crop.*	*An extra crop.*
Ground rent, labouring the ground, and leading the flax	L. 2 10 0	L. 3 10 0	L. 5 0 0
Linſeed from 2l. to 4l. per hogſhead, the medium 3s. 4d. per peck — —	1 16 8 for 11 pecks.	1 10 0 for 9 pecks.	1 6 8 for 8 pecks.
Clodding and ſowing — —	0 2 0	0 2 0	0 2 0
Weeding — — —	0 12 0	0 8 0	nothing.
Pulling, rippling, putting in, and covering in the water — — —	0 14 0	0 15 0	1 0 0
Taking out of the water, graſſing, and ſtacking	0 8 0	0 12 0	0 18 0
Breaking and ſcutching, at 2s. per ſtone —	3 0 0 for 30 ſtones.	4 0 0 for 40 ſtones.	6 0 0 for 60 ſtones.
Total expence	L. 9 2 8	L. 10 17 0	L. 14 6 8
Produce at 10s. per ſtone. — —	L. 15 0 0 for 30 ſtones.	L. 20 0 0 for 40 ſtones.	L. 30 0 0 for 60 ſtones.
Linſeed ſold for oil at 1s. per peck —	0 16 0	0 18 0	1 0 0
The chaff of the bolls is well worth the expence of drying the ſeed; as it is good food, when boiled and mixed with bear, for horſes.			
Total produce	L. 15 16 0	L. 20 18 0	L. 31 0 0
Balance for profit — —	L. 6 14 4	L. 10 1 0	L. 16 13 4

The above eſtimate being made ſeveral years ago, the expence and profit are now different; but the proportions of each are probably the ſame. There is nothing ſtated here as expence of the canal in which the flax is watered; becauſe that varies much according to circumſtances.

It is a certain fact, that the greater the crop is, the better is the quality of the ſame kind of flax.

The advantage of having both a crop of flax and a crop of turnip the ſame year—or of ſowing graſs ſeeds along with the linſeed—and of reducing the ground to a fine garden mould, free of weeds, ought to be attended to.

For Cambric and fine Lawn. The ground muſt be a rich light ſoil, rather ſandy, but cannot be too rich.

It ought to be ploughed in September, or the beginning of October, firſt putting a little hot rotten dung upon it. In January it ought to have a ſecond ploughing, after a hard froſt; and when you intend to ſow it, plough it a third time, or rather hoe it, reducing the clods very fine; but make no furrows: the land muſt be made level like a garden; but never work the land when wet.

The ſeed ſhould be ſown the beginning of April, and about double the quantity that is generally ſown by our farmers; if the land be very rich, it will require rather more than double.

As ſoon as ſown (if the weather be dry) it will be neceſſary to roll the ground.

The lint muſt be weeded very clean when about three inches high; directly after which you muſt ſet forked ſticks, of about one and a half inch thick (which ought to be prepared before), every four or five feet, according to the length of the poles you are to lay upon them; they ſhould be well fixed in the ground, the forked part to receive the poles about ſix or ſeven inches above the lint; each row of poles ſhould be two, three, or four feet aſunder, according to the length of the bruſh-wood you are to lay upon them.

The poles ought to be from 10 to 15 feet long, and ſtrong enough to ſupport the bruſh acroſs the poles; take the longeſt bruſhwood you can get, the more branchy the better, very thick, filling up the vacancies with ſmaller bruſh, and any of the branches that riſe higher than 18 or 20 inches ought to be lopt off to make the bruſh lie as level as poſſible: any ſort of bruſh will do except oak, as that tinges the lint.

Your lint muſt be pulled as ſoon as the ſeed is fully formed, which is a few days after it is out of the bloom, before the lint turn yellow.

It muſt be pulled above the bruſhwood, and every handful laid upon it as ſoon as poſſible: if it is fine weather, leave it four or five hours in that manner: then carry it to a ſcreen near a barn, to put it under cover in caſe of rain; there it muſt be ſpread four or five days, and always put in the barn at night, or when it appears to rain: the bundles muſt be opened in the barn, or made hollow, to prevent it from heating.

Theſe operations muſt be performed until the lint is perfectly dry, and out of danger of heating; taking care all the time to keep the roots as even as poſſible, and if poſſible keep it from rain or wet: if you cannot prevent it from being wet, it will be better to leave it on the graſs till dry; becauſe when once wet, the putting it under cover before dry will make it turn black; a thing which muſt be prevented at all events.

If any of the lint upon the border, or through the piece of ground, be coarſer than another, it muſt be ſeparated from the reſt.

Flax. The utmoſt care muſt be taken to preſerve the lint entire or unbroken; for this reaſon they beat off the ſeed with a round mell or bittle.

The moſt proper ground is ſummer fallow, or after potatoes or lea; if poſſible near a wood, to prevent the expence of carrying bruſh.

As ſoon as the ſeed is off, if you intend to water it that ſeaſon, it muſt be tied in bundles about as large as you can graſp with your two hands.

The water proper for it, is a very ſmall rivulet or ſoft ſpring free of any metellic ore; taking care that no flood or foul water enters your pit; which muſt be at leaſt five feet deep, about nine or ten broad at the top, and ſeven or eight at the bottom; the length will depend on the quantity of flax you have to water. A very ſmall ſtripe of water, when clear, ſhould always be running in and off from your pit when the lint is in it.

The pit ought to be made three or four months before it be uſed.

You muſt drive poles about four inches thick, with a hook inclining downwards, in this form 7, all along the ſides of the pit, above five feet aſunder. The hooks muſt be level with, or rather under, the ſurface of the water. A long pole, the whole length of the pit, muſt be fixed into theſe hooks on each ſide; and croſs poles put under that, to keep the lint under water; but the croſs poles are not uſed till the lint is put in. You muſt order it ſo, that all the lint ſhould be three or four inches under water. You next bring your lint to the ſides of the pit; then put your ſheaves head to head, cauſing each to overlap the other about one-third, and take as many of theſe as make a bundle of two or two and a half feet broad, laying the one above the other till it is about four or four and a half feet high; then you tie them together in the middle, and at each root end: after this you wrap your bundle in ſtraw, and lay it in the water, putting the thin or broad ſide undermoſt, taking care that none of your lint touch the earth; after it is fully preſſed under water, put in your croſs poles to keep it under. The bundles ought to lie in the pit a foot ſeparate from each other. This renders it eaſy to take out; for, if the bundles entangle, they will be too heavy to raiſe.

The time of watering depends ſo much upon the weather, and ſoftneſs or hardneſs of the water, that it is impoſſible to fix any certain time. This muſt be left to the ſkill of the farmer. If the flax be intended for ſpinning yarn ſoft and fit for cambric, it ought to be ſpread upon ſhort graſs for four or five days before you put it into the water; but if for lawns, lace, or thread, it is beſt to dry it outright. In either caſe, avoid as much as poſſible to let it get rain; as much rain blanches and waſhes out the oil, which is neceſſary to preſerve the ſtrength.

The great property of this flax is to be fine and long. Thick ſowing raiſes all plants fine and ſlender; and when the ground is very rich, it forces them to a great length. Pulling green prevents that coarſe hardneſs which flax has when let ſtand till it be full ripe, and gives it the fine ſilky property. The bruſh-wood, when the flax ſprings up catches it by the middle, and prevents it from lying down and rotting; infallible conſequences of ſowing thick upon rich ground. It likewiſe keeps it ſtraight, moiſt, and ſoft at the roots; and by keeping it warm, and ſhaded from the ſun, greatly promotes its length. The keeping it from rain, heating, taking proper care of your water, preſerves the colour, and prevents thoſe bars in cloth ſo much complained of by bleachers. Flax

Flax-Dreſſing. For many ages it was the practice to ſeparate the boon or core from the flax, which is the bark of the plant, by the following ſimple *hand methods*. Firſt, for breaking the boon, the ſtalks in ſmall parcels were beat with a mallet; or, more dexterouſly, the *break* (Plate CCXVIII. fig. 1. and 2.) was uſed thus: The flax being held in the left hand acroſs the three *under teeth* or *ſwords* of the break (*A*, fig. 1. and *a* fig. 2.), the *upper teeth* (*B*, fig. 1. and *b*. fig. 2.) were with the right hand quickly and often forced down upon the flax, which was artfully ſhifted and turned with the left hand. Next, for clearing the flax of the broken boon: the workman with his left hand held the flax over the *ſtock* (fig. 3. and 4.), while with his right hand he ſtruck or thraſhed the flax with the *ſcutcher* (fig. 5.)

Theſe methods of breaking and ſcutching the flax being ſlow and very laborious, a *water-mill* was invented in Scotland about the year 1750; which, with ſome improvements, makes great deſpatch, and in ſkilful and careful hands gives ſatisfaction. It has been generally conſtructed to break the boon by three dented rollers, placed one above the other. The middle one of which, being forced quickly round, takes the other two along with it, and one end of the handfuls of the flax being by the workmen directed in between the upper and middle rollers, the flax is immediately drawn in by the rollers; a curved board or plate of tin behind the rollers directs the flax to return again between the middle and undermoſt rollers;—and thus the operation is repeated until the boon be ſufficiently broke. Great weights of timber or ſtone at the ends of levers, preſs the upper and under rollers towards the middle one.

The ſcutching is next carried on by the mill in the following manner: Four arms, ſomething like the hand-ſcutchers before deſcribed, project from a perpendicular axle; a box around the axle encloſes theſe projecting ſcutchers; and this box is divided among the workmen, each having ſufficient room to ſtand and handle his flax, which, through ſlits in the upper part and ſides of the box, they hold in to the ſtroke of the ſcutchers; which, moving round horizontally, ſtrike the flax acroſs or at right angles, and ſo thraſh out or clear it of the boon.

The breaking of the flax by *rollers* is ſcarcely ſubject to any objection, but that it is dangerous to workmen not ſufficiently on their guard, who ſometimes allow the rollers to take hold of their fingers, and thereby their whole arm is inſtantly drawn in: thus many have loſt their arms. To avoid this danger, a break, upon the general principles of the hand-break before deſcribed, has been lately adapted to water-machinery, and uſed in place of rollers. The horizontal ſtroke of the ſcutchers was long thought too ſevere, and waſteful of the flax; but very careful experiments have diſcovered that the waſte complained of muſt be charged to the unſkilfulneſs or negligence of the workmen, as in good hands the mill carries away nothing but what, if not ſo ſcutched off, muſt be

Flax. be taken off in the heckling, with more loſs both of time and flax. But to obviate this objection of the violence of the *horizontal ſcutchers*, an imitation of hand-ſcutching has lately been applied to water. The ſcutchers then project from a horizontal axle, and move like the arms of a check reel, ſtriking the flax neither acroſs nor perpendicularly down, but ſloping in upon the parcel exactly as the flax is ſtruck by the hand-ſcutcher. This ſloping ſtroke is got by raiſing the ſcutching ſtock ſome inches higher than the centre of the axle; and by raiſing or lowering the ſtock over which the flax is held, or ſcrewing it nearer to or farther from the ſcutchers, the workman can temper or humour the ſtroke almoſt as he pleaſes.

A lint mill, with horizontal ſcutchers upon a perpendicular axle, requires a houſe of two ſtories, the rollers or break being placed in the ground ſtory, and the ſcutchers in the loft above; but a mill with vertical ſcutchers on a horizontal axle, requires but one ground ſtory for all the machinery.

Another method of breaking and ſcutching flax, more expeditious than the old hand methods, and more gentle than water mills, has alſo been invented in Scotland. It is much like the break and ſcutcher, giving the ſloping ſtroke laſt deſcribed, moved by the foot. The treddle is remarkably long, and the ſcutchers are fixed upon the rim of a fly wheel. The foot-break is alſo aſſiſted in its motion by a fly. Theſe foot machines are very uſeful where there are no water mills, but they are far inferior to the mills in point of expedition.

The next operation that flax undergoes after ſcutching is heckling. The *heckle* (fig. 6.) is firmly fixed to a bench before the workman, who ſtrikes the flax upon the teeth of the heckle, and draws it through the teeth. To perſons unacquainted with that kind of work this may ſeem a very ſimple operation; but, in fact, it requires as much practice to acquire the ſlight of heckling well, and without waſting the flax, as any other operation in the whole manufacture of linen. They uſe coarſer and wider teethed heckles, or finer, according to the quality of the flax; generally putting the flax through two heckles, a coarſer one firſt, and next a fine one.

Flax for Cambric and fine Lawn, Thread, and Lace, is dreſſed in a manner ſomewhat different. It is not ſcutched ſo thoroughly as common flax; which from the ſcutch proceeds to the heckle, and from that to the ſpinner: whereas, this fine flax, after a rough ſcutching, is ſcraped and cleanſed with a blunt knife upon the workman's knee covered with his leather apron; from the knife it proceeds to the ſpinner, who, with a bruſh made for the purpoſe, ſtraights and dreſſes each parcel juſt before ſhe begins to ſpin it.

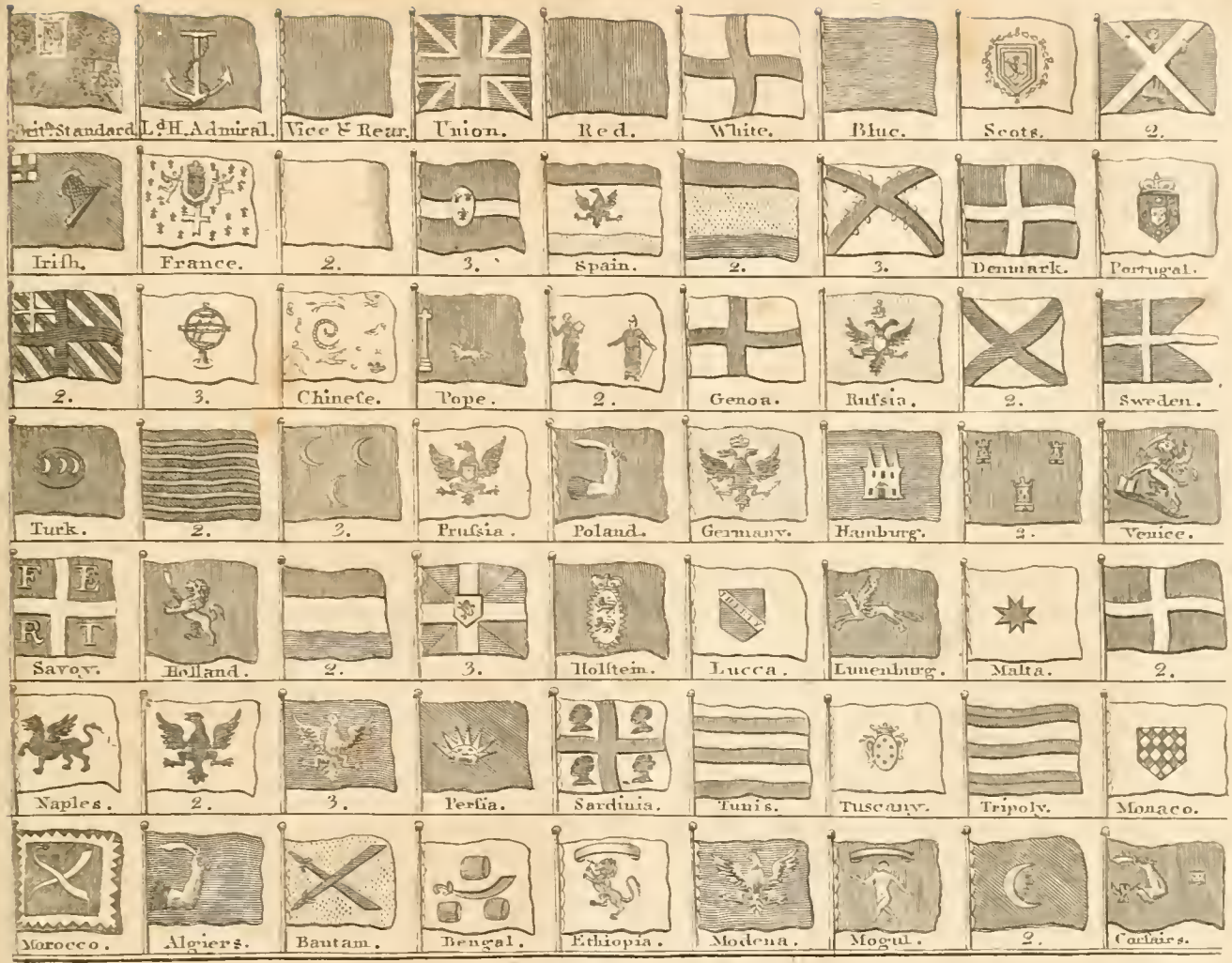
The following obſervations on this ſubject, firſt publiſhed in the Gentleman's Magazine for June 1787, ſeem worthy of particular attention.

Of the watering of Flax by a new method, ſo as to ſhorten labour, to add probably to the ſtrength of the flax, and to give it a much finer colour, which would render the operation of bleaching ſafer and leſs tedious.

"Though the following reflections have for their object an improvement in the very eſſential article of watering of flax, yet I muſt adverti ſe the reader, that they are only theory, and muſt depend entirely for their truth and juſtification upon future experiments, ſkilfully and judiciouſly made. Should repeated trials prove the advantage of the new method propoſed, we may venture to affirm, that it would be an improvement that would increaſe the national income in the agricultural branch many thouſand pounds annually, would add greatly to the perfection of the linen manufacture, and over and above would ſuppreſs a very diſagreeable nuiſance, which the preſent method of watering flax occaſions during ſome part of the ſummer in every flax-growing country. Flax.

"The intention of watering flax is, in my opinion, to make the boon more brittle or friable, and, by ſoaking, to diſſolve that gluey kind of ſap that makes the bark of plants and trees adhere in a ſmall degree to the woody part. The bark of flax is called the *harle;* and when ſeparated from the uſeleſs woody part, the *boon*, this harle itſelf is called flax. To effect this ſeparation eaſily, the practice has long prevailed, of ſoaking the flax in water to a certain degree of fermentation, and afterwards drying it. For this ſoaking ſome prefer rivulets that have a ſmall current, and others ſtagnant water in ponds and lakes. In both methods the water acts as in all other caſes of infuſion and maceration; after two or three weeks it extracts a great many juices of a very ſtrong quality, which in ponds give the water an inky tinge and offenſive ſmell; and in rivulets mix in the ſtream and kill the fiſh. Nay, if this maceration be too long continued, the extracted and fermented ſap will completely kill the flax itſelf. For if, inſtead of two or three weeks, the new flax were to lie ſoaking in the water four or five months, I preſume it would be good for nothing but to be thrown upon the dunghill; both harle and boon would in time be completely rotted; yet the harle or flax, when entirely freed from this ſap, and manufactured into linen, or into ropes, might lie many months under water without being much damaged; as linen, it may be waſhed and ſteeped in ſcalding water twenty times without loſing much of its ſtrength; and as paper, it acquires a kind of incorruptibility.

"It appears then eſſential to the right management of new flax, to get rid of this pernicious vegetative ſap, and to macerate the boon; but from the complaints made againſt both the methods of watering now in uſe, there is reaſon to think that there is ſtill great room for improvement in that article. In rivulets, the vegetative ſap, as it is diſſolved, is carried off by the current, to the deſtruction of the fiſh. This prevents the flax from being ſtained; but the operation is tedious, and not complete, from the uncertainty of knowing when it is juſt enough, and not too much, or perhaps from neglect. In ponds, the inky tinge of the water often ſerves as a kind of dye to the flax, which imbibes it ſo ſtrongly, that double the labour in bleaching will hardly bring the linen made of ſuch flax to an equality in whiteneſs with linen made of flax untinged. This ſeems to be equally unwiſe as though we were to die cotton black firſt, in order to whiten it afterwards. Theſe ponds, beſides, become a great nuiſance to the neighbourhood; the impregnated water is often of ſuch a pernicious quality, that cattle,



FLAX.

Fig. 1. Flax hand break.

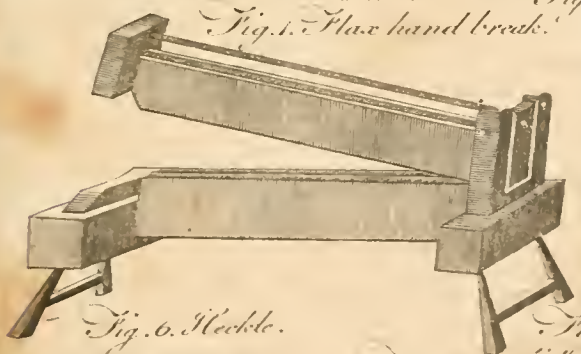


Fig. 2. Section of the break.

Skutching Stock.

Fig. 6. Heckle.

Fig. 3. Side view.

Fig. 4. Front view.

Fig. 5. Hand Skutcher.

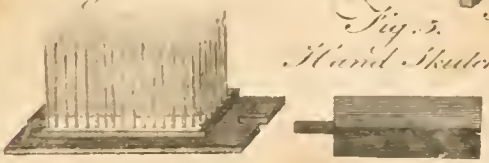


Fig. 7. Plan of the Heckle.

FLOATING BODIES.

Fig. 1.

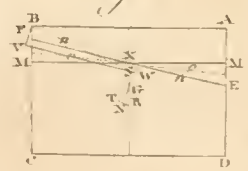
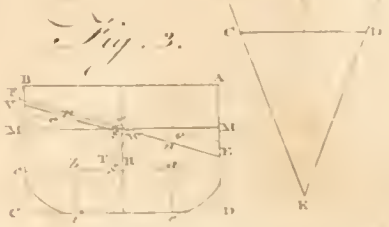


Fig. 2.

Fig. 3.



Flax. cattle, however thirſty, will not drink of it; and the effluvia of it may perhaps be nearly as infectious as it is offenſive. If this effluvia is really attended with any contagious effects in our cold climate, a thing worth the inquiring into, how much more pernicious muſt its effects have been in the hot climate of Egypt, a country early noted for its great cultivation of flax?

"I have often thought that the proceſs of watering might be greatly improved and ſhortened by plunging the new flax, after it is rippled, into ſcalding water; which, in regard to extracting the vegetative ſap, would do in five minutes more than cold water would do in a fortnight, or perhaps more than cold water could do at all, in reſpect to the clearing the plant of ſap. Rough almonds, when thrown into ſcalding water, are blanched in an inſtant; but perhaps a fortnight's macerating thoſe almonds in cold water would not make them part ſo eaſily with their ſkins, which are the ſame to them as the harle is to the flax. Were tea leaves to be infuſed in cold water a fortnight, perhaps the tea produced by that infuſion would not be ſo good to the taſte, or ſo ſtrongly tinged to the eye, as what is effected by ſcalding water in five minutes. By the ſame analogy, I think, flax or any ſmall twig would be made to part with its bark much eaſier and quicker by being dipped in boiling water than by being ſteeped in cold water.

"This reflection opens a door for a great variety of new experiments in regard to flax. I would therefore recommend to gentlemen cultivators and farmers, to make repeated trials upon this new ſyſtem, which would ſoon aſcertain whether it ought to be adopted in practice or rejected. One thing, I think, we may be certain of, that if the Egyptians watered their flax in our common manner, they undoubtedly watered it in *very warm water*, from the great heat of their climate, which would probably make them neglect to think of water heated by any other means than that of the ſun. A good general practice can only be eſtabliſhed upon repeated trials. Though one experiment may fail, another with a little variation may ſucceed; and the importance of the object deſired to be obtained will juſtify a good degree of perſeverance in the proſecution of the means. In this view, as the Chineſe thread is ſaid to be very ſtrong, it would be worth while to be acquainted with the practice of that diſtant nation, in regard to the rearing and manufacturing of flax, as well as with the methods uſed by the Flemings and the Dutch.

"Boiling water perhaps might at once clear the new flax from many impurities, which when not removed till it be ſpun into yarn, are then removed with difficulty, and with loſs of ſubſtance to the yarn. Why ſhould not the longitudinal fibres of the flax, before they be ſpun into yarn, be made not only as *fine* but as *clean* as poſſible? Upon the new ſyſtem propoſed, the act of bleaching would begin immediately after the rippling of the flax; and a little done then, might perhaps ſave much of what is generally done after the ſpinning and weaving. To ſpin dirty flax with a view of cleaning it afterwards, appears to be the ſame impropriety as though we were to reſerve part of the dreſſing given to leather till after it is made into a glove.

"Should the plunging of the flax into the boiling water not ſuffice to make the boon brittle enough, as I am inclined to think it would not, then the common watering might be added; but in that caſe probably half the time uſually given to this watering would ſuffice, and the flax might then be laid in clear rivulets, without any apprehenſion of its infecting the water and poiſoning the fiſh, or of being diſcoloured itſelf; for the boiling water into which it had been previouſly put, would have extracted all the poiſonous vegetative ſap, which I preſume is what chiefly diſcolours the flax or kills the fiſh. Flax.

"On the ſuppoſition, that the uſe of boiling water in the preparation of flax may be found to be advantageous and profitable, I can recollect at preſent but one objection againſt its being generally adopted. Every flax-grower, it may be ſaid, could not be expected to have conveniences for boiling water ſufficient for the purpoſe; the conſumption of water would be great; and ſome additional expence would be incurred. In anſwer to this, I ſhall obſerve, that I preſume any additional expence would be more than reimburſed by the better marketable price of the flax; for otherwiſe any new improvement, if it will not quit coſt muſt be dropt, were it even the ſearching after gold. In a large caldron a great deal of flax might be dipt in the ſame water, and the conſumption perhaps would not be more than a quart, to each ſheaf. Even a large houſehold pot would be capable of containing one ſheaf after another; and I believe the whole objection would be obviated, were the practice to prevail with us, as in Flanders and Holland, that the flax-grower and the flax-dreſſer ſhould be two diſtinct profeſſions.

"I ſhall conclude with recommending to thoſe who are inclined to make experiments, not to be diſcouraged by the failure of one or two trials.—Perhaps the flax, inſtead of being juſt plunged into the ſcalding water, ought to be kept in it five minutes, perhaps a quarter of an hour, perhaps a whole hour. Should five minutes or a quarter of an hour, or an hour, not be ſufficient to make the boon and harle eaſily ſeparate, it might perhaps be found expedient to boil the flax for more than an hour; and ſuch boiling when in this ſtate might in return ſave ſeveral hours boiling in the article of bleaching. It is not, I think, at all probable that the boiling of the flax with the boon in it would prejudice the harle; for in the courſe of its future exiſtence, it is made to be expoſed 20 or 40 times to this boiling trial; and if not detrimental in the one caſe, it is to be preſumed it would not be detrimental in the other. Perhaps after the boiling, it would be proper to pile up the flax in one heap for a whole day, or for half a day, to occaſion ſome fermentation; or perhaps, immediately after the boiling, it might be proper to waſh it with cold water. The great object, when the flax is pulled, is to get the harle from the boon with as little loſs and damage as poſſible; and if this is accompliſhed in a more complete manner than uſual, conſiderable labour and expence will be ſaved in the future manufacturing of the flax. On this account I think much more would be gained than loſt, were the two or three laſt inches of the roots of the ſtems to be chopped off, or clipt off previous to the flax being either watered or boiled. When the flax is watered, care ſhould be taken not to ſpread it out to

Flax. dry, when there is a hazard of its being expoſed in its wet ſtate to froſt."

To what we have now ſaid we ſhall add the following ſhort account of the flax huſbandry of Ireland, in a letter which appeared in the Farmers Magazine, vol. vii. page 35.

"Having for ſeveral years (ſays the writer) been engaged in the culture of flax, I devoted a part of laſt ſummer to a tour through the manufacturing diſtricts of Ireland. Here that branch of huſbandry has long been eſtabliſhed over a large extent of the country, and conducted with very conſiderable ſucceſs. As ſome of the proceſſes in this culture, which are followed with advantage, are either unknown to the Scots farmers, or are performed in a very awkward and inefficient manner, it might, I conceive, prove of no ſmall benefit, were ſome of your intelligent correſpondents induced to lay before them a plain ſketch of the peculiar management obſerved by the Iriſh peaſantry in this important article. I am the more deſirous it ſhould appear in your pages, becauſe a periodical work on huſbandry, conducted by a practical farmer, appears before the public with manifeſt advantage, and is received with that ſort of deference which is due to experience and authority. The diſcuſſions of actual cultivators regarding the objects of their own profeſſion, however new they may as yet be in the annals of agriculture, are far more likely to prove uſeful, than the writings of thoſe volunteers in this favourite ſcience, who are merely ſpeculative and theoretical. I freely confeſs to you, Sir, that I found with pleaſure your work widely circulated in the ſiſter kingdom; and that the cauſe uniformly given for its popularity, was a degree of confidence placed in the practical ſkill of its conductor.

"During my progreſs through Ireland, the ſeveral proceſſes of *ſteeping*, *drying*, and *ſkutching*, were in hand, and I think I found a peculiarity of management in theſe ſufficient to affect the ſucceſs of the whole buſineſs, and to confer a decided ſuperiority on the produce of an acre of flax in Ireland over that in Scotland, both in quantity and value. It is no uncommon thing for a farmer in this country, who wiſhes to make up a ſum for his rent, to ſell a part of his *lint on the foot*, as it is termed; and for this he will commonly receive from 30 to 40 guineas per acre.

"1. *The Method of Steeping.*—As ſoon as the crop has attained the proper degree of ripeneſs, (which is ſomewhat below your ſtandard of maturity), the flax is pulled, and carried to a ſtagnant pool, dug for this purpoſe, moderately deep. It is allowed to remain there only from *five* to *ſeven* days, according to the temperature of the weather. After the fermentation in the ſteeping proceſs has been carried to a degree ſufficient to produce the requiſite laxity of fibre, the flax is taken out of the pool, and ſpread *very thinly* on the ſtubble of the hay meadow. There, inſtead of remaining till it is merely dried, it is continued for three or four weeks, till the grower conceives it ready for ſkutching. This blenching proceſs, if I am allowed to call it ſo, which, in Scotland, is either unknown, or continued merely till the crop is dried, has many advantages; the moſt obvious one is, that it enables the farmer, every time he examines it, to aſcertain exactly (by rubbing on his hand) the preciſe point at which the fermentation has arrived, and thus to perceive the tenacity and ſtrength of his flax; while the adheſion of the fibre has been ſufficiently weakened, to admit of the ſkutcher cleanſing it completely of the woody parts. It is, I am apprehenſive, only the practical flax farmer who is able to judge of the importance and delicacy of this part of the huſbandry. It is ſo remarkable, that of two acres of flax, under preciſely the ſame ſeed and culture, and of equal fertility, it frequently happens that the one ſhall yield a produce thrice the value of the other, merely from ſuperior accuracy in aſcertaining the proper line of continuing the ſteeping and blenching proceſſes. In Scotland, therefore, I ſuſpect the practice is faulty and defective; becauſe there the whole proceſs of fermentation is completed by ſteeping alone; whereas, in Ireland, it is begun only in the ſteep, and completed by blenching on the meadow, to that preciſe point which the ſafety of the produce requires. Flax.

"2. *Smoking and Drying.*—The Iriſh peaſant ſeems to poſſeſs another advantage, almoſt equally deciſive, in his mode of drying the flax, before he ſubmits it to the ſkutcher or beater. After the lint has remained a ſufficient length of time on the blenching green, it is gathered up a ſecond time into ſheafs, (beats, provincially), and ſeems tolerably dry. In this ſtate it is deemed by the Scots growers fully prepared for the flax-mill; but far otherwiſe by the Iriſh farmer, who never ſubmits it to the hands of the beaters till it has undergone a thorough ſmoking over a peat fire. For this purpoſe, he raiſes, at the back of a ditch, a ſmall hurdle thinly wrought with oſiers, and places it on four poſts of wood, at the height of four feet above the level of the ground. A pretty ſtrong fire of peats being kindled below, the heat and ſmoke pervade every part of the flax, which is placed perpendicularly above the hurdle. This proceſs is continued, and freſh quantities of flax regularly added, till the whole crop is brought to a ſtate of dryneſs, which, in this moiſt climate, can never be effected by the ſun and the weather alone: by this operation a degree of brittleneſs and friability is produced on the ſtraw, which greatly facilitates the enſuing work, and admits of an eaſy ſeparation of the fibre from the wood. It is evident, that the leſs friction required in ſkutching, the leſs waſte or diminution muſt be occaſioned in clearing the flax; and conſequently, the greater muſt be the grower's produce from the mill. This part of the proceſs is equally delicate with that deſcribed above, and requires, if poſſible, ſtill greater attention on the part of the workmen, ſince it is clear that, by a careleſs management of the fire, the whole crop may be deſtroyed.

"3. *Cleanſing and Dreſſing.*—The flax huſbandry of Ireland derives no ſmall benefit from the application of hand-labour in the beating and ſkutching of lint, thus ſuperſeding the uſe of the mill. The moſt careful and expert workmen are not always able to temper the velocity of machinery ſo exactly, as to preſerve flax that has been overſteeped or blenched to exceſs: while the ſteady and regulated *impetus* of the hand-ſkutch can eaſily be modified, as the circumſtances of each caſe may require; a matter of obvious advantage, becauſe the beſt flax-mills ſeldom produce an equal quantity of lint, nor equally clean, with that which is obtained by the hand. Beſides this, the price of labour, in this part of the united kingdom, ſtill continues ſo moderate, as to preclude any conſiderable degree of ſaving in expence

Flax. pence by the uſe of machinery. In proof of this, the flax millers in Scotland, I find, are charging this ſeaſon from three to four ſhillings for dreſſing a ſtone of flax; while, at the place I am now writing, the ſame quantity is dreſſed by the hand for thirteenpence, or one Britiſh ſhilling. In Scotland, where hands are ſcarce, and the price of labour conſequently high, I certainly would not recommend the diſuſe of the flax-mill; on the contrary, I am perſuaded that it is chiefly owing to our ſuperior machinery, and excellent implements of huſbandry, that we are at all enabled to maintain a competition with our neighbours in the preſent ſtate of our ſkill in flax huſbandry, and ſubjected to the diſadvantage of paying double price for our labour.

"4. *Preſervation of Flax-ſeed.*—The laſt peculiarity of management, which I ſhall at preſent notice as advantageous to the flax huſbandry of Ireland, is the invention of a flax barn for the preſervation of ſeed. Enjoying a climate perhaps ſtill more moiſt and unſteady than that of Great Britain, the farmers here were for a long ſeries of years, unable to ſupply themſelves with this article, and were obliged to commiſſion ſeed annually from America and the Baltic, to ſupply the increaſed demands of an extending culture, to the large amount of 200,000l. ſterling. This annual expenditure of caſh long continued to operate as a drain on the ſtock of the laborious farmer, and prevented the accumulation of his capital; an evil of the moſt ſerious magnitude, under which the Iriſh peaſantry ſtill labour, and from which, till very lately, they had not even a proſpect of relief. By the practice in univerſal uſe, if the farmer ſtored up his lint in the barn-yard with the reſt of his crop in harveſt, he might, it is true, preſerve his ſeed; but in doing ſo, he uniformly loſt his flax to a far greater value from overdryneſs, when wrought in the ſpring.

"If, on the other hand, he attempted to ſeparate his ſeed during the lint harveſt by means of the rippling-comb, he had no means of preventing it from being almoſt invariably deſtroyed by the wetneſs of the climate. Various methods had been attempted to overcome this difficulty, but without ſucceſs; till Robert Tennant, Eſq. of Strangmore, linen-inſpector, near Dungannon, contrived the plan of a flax-barn, which ſeems perfectly competent to the preſervation of ſeed. It has already been erected, and has proved ſucceſsful on a ſmall ſcale; the ſeed cured in it remained during the winter perfectly freſh, and nothing ſeems wanting to complete this improvement in our flax huſbandry, but a larger capital in the hands of a few of our farmers. This flax barn is conſtructed on wooden poſts, roofed on the top, but left perfectly open at each ſide; it is ſupplied with various ſtages of floors of baſket-work, placed regularly at two feet diſtance above each other. Thus, the air, having free acceſs to the ſeed on all ſides, preſerves it freſh and well-coloured for any length of time.

"This contrivance was ſuggeſted to Mr Tennant, it is ſaid, almoſt caſually, by noticing the great effect produced on cloth, by drying-houſes in bleachfields. He had in fact been employed by the Linen Board of Ireland, in teaching the new proceſs of bleaching to the manufacturers, by means of the oxymuriate of lime; and, in the courſe of ſeven or eight years, this method of whitening linen has been eſtabliſhed over the whole kingdom, with the exception of hardly a ſingle field. Lord Northland and Mr Foſter, who invited this gentleman from Scotland, and patronized him in this part of the kingdom, have enjoyed the ſatisfaction of beholding a more eſſential improvement effected in the linen manufacture, in the ſhort ſpace already mentioned, than had ever taken place in a century before. Flax, Flea.

"It was my intention, when I began this letter, to have preſented you a more minute deſcription of a flax farm, and to have laid before your readers, a more detailed account of the flax huſbandry of Ireland in general. I find, however, that I have already exceeded the ordinary bounds preſcribed to the contributors to your uſeful work; therefore conclude, with expreſſing a hope, that the few hints already offered, will incline ſome of your correſpondents to treat of a ſubject certainly of ſufficient importance to merit attention. For a branch of huſbandry cannot be deemed contemptible, which affords ſuſtenance to upwards of two millions of people; and which, at the ſame time, adds to the general reſources of the empire, no leſs a ſum than ſeven millions ſterling annually. Theſe circumſtances, too, I truſt, will plead my excuſe for holding up a portion of Iriſh huſbandry to the imitation of your numerous readers among the cultivators of Scotland, who are at preſent juſtly celebrated for their agricultural knowledge in every part of the world."

Flax made to reſemble Cotton. In the Swediſh Tranſactions for the year 1747, a method is given of preparing flax in ſuch a manner as to reſemble cotton in whiteneſs and ſoftneſs, as well as in coherence. For this purpoſe, a little ſea water is to be put into an iron pot or an untinned copper kettle, and a mixture of equal parts of birch aſhes and quicklime ſtrewed upon it: A ſmall bundle of flax is to be opened and ſpread upon the ſurface, and covered with more of the mixture, and the ſtratification continued till the veſſel is ſufficiently filled. The whole is then to be boiled with ſea water for ten hours, freſh quantities of water being occaſionally ſupplied in proportion to the evaporation, that the water may never become dry. The boiled flax is to be immediately waſhed in the ſea by a little at a time, in a baſket, with a ſmooth ſtick at firſt while hot; and when grown cold enough to be borne by the hands, it muſt be well rubbed, waſhed with ſoap, laid to bleach, and turned and watered every day. Repetitions of the waſhing with ſoap expedite the bleaching; after which the flax is to be beaten, and again well waſhed; when dry it is to be worked and carded in the ſame manner as common cotton, and preſſed betwixt two boards for 48 hours. It is now fully prepared and fit for uſe. It loſes in this proceſs near one half its weight, which is abundantly compenſated by the improvement made in its quality.

The filamentous parts of different vegetables have been employed in different countries for the ſame mechanic uſes as hemp and flax among us. See FILAMENT.

Earth-Flax. See AMIANTHUS, BOTANY *Index.*

New Zealand Flax Plant. See PHORMIUM, BOTANY *Index.*

Toad-Flax. See LINARIA, BOTANY *Index.*

FLEA. See PULEX, ENTOMOLOGY *Index.*

Flea-

Fleam || Fleet.

Flea-Bane. See Conyza, Botany *Index.*

Flea-Bitten, that colour of a horſe which is white or gray, ſpotted all over with dark reddiſh ſpots.

FLEAM, in *Surgery* and *Farriery*, an inſtrument for letting blood of a man or horſe. A caſe of fleams, as it is called by farriers, comprehends ſix ſorts of inſtruments; two hooked ones, called *drawers*, and uſed for cleanſing wounds; a pen knife; a ſharp-pointed lancet for making inciſions; and two fleams, one ſharp and the other broad pointed. Theſe laſt are ſomewhat like the point of a lancet, fixed in a flat handle, and no longer than is juſt neceſſary to open the vein.

FLECHIER, Esprit, biſhop of Niſmes, one of the moſt celebrated preachers of his age, and the publiſher of many panegyrics and funeral orations, was born at Perne in Avignon in 1632. He was nominated to the biſhopric of Lavaur in 1685, and tranſlated to Niſmes in 1687. At this latter place he founded an academy, and took the preſidentſhip upon himſelf: his own palace was indeed a kind of academy, where he applied himſelf to train up orators and writers, who might ſerve the church, and do honour to the nation. He publiſhed, beſides his panegyrics and funeral orations, 1. A Hiſtory of the Emperor Theodoſius, that of Cardinal Ximenes, and that of Cardinal Commendon. 2. Several Sermons. 3. Miſcellaneous Works. 4. Letters, &c. He died in 1710.

FLECKNOE, Richard, an Engliſh poet in the reign of Charles II. more remarkable for Mr Dryden's ſatire on him than for any works of his own. He is ſaid to have been originally a Jeſuit, and to have had good Engliſh connexions in the Catholic intereſt. When Dryden loſt the place of poet laureat on the Revolution, its being conferred on Flecknoe, for whom he had a ſettled averſion, gave occaſion to his poem entitled *Mac Flecknoe;* one of the beſt written ſatires in our language, and from which Pope ſeems to have taken the hint for his Dunciad. Flecknoe wrote ſome plays; but could never get more than one of them acted, and that was damned.

FLEECE, the covering of wool ſhorn off the bodies of ſheep. See Wool.

Golden Fleece. See Argonauts, and *Golden Fleece.*

FLEET, commonly implies a company of ſhips of war, belonging to any prince or ſtate: but ſometimes it denotes any number of trading ſhips employed in a particular branch of commerce.

The admirals of his Britannic majeſty's fleet are divided into three ſquadrons, viz. the red, the white, and the blue. When any of theſe officers are inveſted with the command of a ſquadron or detachment of men of war, the particular ſhips are diſtinguiſhed by the colours of their reſpective ſquadron: that is to ſay, the ſhips of the red ſquadron wear an enſign whoſe union is diſplayed on a red field; the enſigns of the white ſquadron have a white field; and thoſe of the blue ſquadron a blue field; the union being common to all three. The ſhips of war, therefore, are occaſionally annexed to any of the three ſquadrons, or ſhifted from one to another.

Of whatſoever number a fleet of ſhips of war is compoſed, it is uſually divided into three ſquadrons; and theſe, if numerous, are again ſeparated into diviſions. The admiral, or principal officer, commands the centre; the vice admiral, or ſecond in command, ſuperintends the van guard; and the operations of the rear are directed by the rear admiral, or the officer next in rank. See the article Division. Fleetwood Flemingians.

The diſpoſition of a fleet, while proceeding on a voyage, will in ſome meaſure depend on particular circumſtances; as the difficulty of the navigation, the neceſſity of diſpatch, according to the urgency or importance of the expedition, or the expectation of an enemy in the paſſage. The moſt convenient order is probably to range it into three lines or columns, each of which is parallel to a line cloſe hauled according to the tack on which the line of battle is deſigned to be formed. This arrangement is more uſeful than any; becauſe it contains the advantages of every other form without their inconveniences. The fleet being thus more encloſed will more readily obſerve the ſignals, and with greater facility form itſelf into the line of battle, a circumſtance which ſhould be kept in view in every order of ſailing. See *Naval Tactics.*

Fleet, is alſo a noted priſon in London, where perſons are committed for contempt of the king and his laws, particularly of his courts of juſtice; or for debt, where any perſon will not or is unable to pay his creditors.

There are large rules and a warden belonging to the Fleet priſon; which had its name from the float or fleet of the river or ditch, on the ſide whereof it ſtands.

FLEETWOOD, William, a very learned Engliſh biſhop in the beginning of the 18th century, of an ancient family in Lancaſhire. He diſtinguiſhed himſelf during King William's reign, by his *Inſcriptionum Antiquarum Sylloge*, by ſeveral ſermons he preached on public occaſions, and by his Eſſay on Miracles. He was deſigned by King William to a canonry of Windſor. The grant did not paſs the ſeals before the king's death; but the queen gave it him, and he was inſtalled in 1702. In 1703, he took a reſolution to retire; and in 1707, publiſhed, without his name, his *Chronicon Pretioſum.* In 1708, he was nominated by the queen to the ſee of St Aſaph. The change of the queen's miniſtry gave him much regret. In 1715, he publiſhed a pamphlet entitled, "The 13th chapter of the Romans vindicated from the abuſive ſenſes put upon it." In 1714, he was tranſlated to the biſhopric of Ely; and died in 1723, aged 67. He publiſhed ſeveral other ſermons and tracts, and was a man of great learning and exemplary piety.

FLEMINGIANS, or Flandrians, in eccleſiaſtical hiſtory, a ſect of rigid Anabaptiſts, who acquired this name in the 16th century, becauſe moſt of them were natives of Flanders, by way of diſtinction from the Waterlandians. In conſequence of ſome diſſenſions among the Flemingians relating to the treatment of excommunicated perſons, they were divided into two ſects, diſtinguiſhed by the appellations of *Flandrians* and *Frieſlanders*, who differed from each other in their manners and diſcipline. Many of theſe in proceſs of time came over to the moderate community of the Waterlandians, and thoſe who remained ſeparate are ſtill known by the name of the old Flemingians or Flandrians; but they are comparatively few in number. Theſe maintain the opinion of Menno with reſpect to the incarnation of Chriſt; alleging, that his

Flemiſh || Fletcher.

body was produced by the creating power of the Holy Ghoſt, and not derived from his mother Mary.

FLEMISH, or the FLEMISH TONGUE, is that which we otherwiſe call *Low Dutch*, to diſtinguiſh it from the *German*, whereof it is a corruption and a kind of dialect. See GERMAN.

It differs from the *Walloon*, which is a corruption of the French language. The Flemiſh is uſed through all the provinces of the Netherlands.

FLEMISH Bricks, a neat, ſtrong, yellow kind of bricks, brought from Flanders, and commonly uſed in paving yards, ſtables, &c. being preferable for ſuch purpoſes to the common bricks. See the article BRICKS.

FLESH, in *Anatomy*, a compound ſubſtance, conſiſting of the various ſofter ſolids of the animal body, and ſo denominated in contradiſtinction to bones. See ANATOMY, *paſſim*.

FLESH is alſo uſed, in *Theology*, in ſpeaking of the myſteries of the incarnation and euchariſt. "The word was made *fleſh*," *Verbum* caro *factum eſt*.

The Romaniſts hold, that the bread in the ſacrament of the ſupper is turned into the real fleſh of Jeſus Chriſt. See TRANSUBSTANTIATION.

FLESH is ſometimes alſo uſed by botaniſts for the ſoft pulpy ſubſtance of any fruit, encloſed between the outer rind or ſkin and the ſeeds or ſtone; or for that part of a root, fruit, &c. fit to be eaten.

FLESH-Colour. See CARNATION.

FLETA, the name given to an unknown writer who lived about the end of the reign of Edward II. and beginning of Edward III. and who being a priſoner in the Fleet, wrote there an excellent treatiſe on the common law of England.

FLETCHER. See *BEAUMONT and Fletcher*.

FLETCHER, *Andrew*, of Salton, a celebrated Scots patriot and political writer, was deſcended from an ancient family who trace their origin to one of the followers of William the Conqueror. He was the ſon of Sir Robert Fletcher of Salton and Innerpeffer, and born in the year 1650. The tuition of our author was committed by his father, on his deathbed, to Mr (afterwards Biſhop) Burnet, then his pariſh miniſter; by whoſe care he received a pious, learned, and polite education. Endowed with uncommon genius, and poſſeſſed of virtues and abilities peculiarly ſuited to the times in which he lived, Mr Fletcher quickly ſhone forth the ornament of his country, and the champion of its freedom. Having in the courſe of his claſſical ſtudies and hiſtorical reading been impreſſed with an enthuſiaſtic admiration both of ancient and modern republics, he had early contracted an ardent love of liberty, and an averſion to arbitrary rule. Hence his ſpirit the more readily took alarm at certain meaſures in the reign of Charles II. Being knight of the ſhire for Lothian to that parliament where the duke of York was commiſſioner, he openly oppoſed the deſigns of that prince and the bill of acceſſion. He had a ſhare with lord viſcount Stair in framing the teſt act, by which the duke of York complained that he loſt Scotland. On theſe accounts he became peculiarly obnoxious to the duke; and was at laſt obliged to flee to Holland, to avoid the fatal conſequences of proſecutions which on various pretences were commenced againſt him. Being cited before the privy council and juſticiary courts, and not appearing, he was declared traitor, and his eſtate confiſcated. Fletcher

In Holland, he and Mr Baillie of Jerviſwood were the only perſons whom the earl of Argyle conſulted concerning the deſigns which were then in agitation. In 1681 they came over to England, in order to concert matters with their party in that country; and were the only two who were intruſted ſo far as to be admitted to the ſecrets of Lord Ruſſell's council of ſix. Mr Fletcher managed his part of the negotiation with ſo much addreſs, that adminiſtration could find no pretext for ſeizing him; nor could they fix upon him thoſe articles on account of which Mr Baillie was condemned; to whoſe honour let it be remembered, that although offered a pardon on condition of his accuſing his friend, he perſiſted in rejecting the propoſal with indignation.

Mr Fletcher having joined the duke of Monmouth upon his landing, received a principal command under him; but the duke was deprived of his ſervices on the following occaſion, as related by Sir John Dalrymple. Being ſent upon an expedition, and not eſteeming "times of danger to be times of ceremony," he had ſeized for his own riding the horſe of a country gentleman [the mayor of Lynne] which ſtood ready equipped for its maſter. The maſter, hearing this, ran in a paſſion to Fletcher, gave him opprobrious language, ſhook his cane, and attempted to ſtrike. Fletcher, though rigid in the duties of morality, having been accuſtomed to foreign ſervice both by ſea and land, in which he had acquired high ideas of the honour of a ſoldier and a gentleman, and of the affront of a cane, pulled out his piſtol, and ſhot him dead on the ſpot. The action was unpopular in countries where ſuch refinements were not underſtood. A clamour was raiſed againſt it among the people of the country: in a body they waited upon the duke with their complaints; and he was forced to deſire the only ſoldier, and almoſt the only man of parts, in his army, to abandon him. With Fletcher all Monmouth's chance of ſucceſs in war left him." But, in a manuſcript memoir belonging to the family, we have the following notice concerning Mr Fletcher's connection with Monmouth, in which his ſeparation from that prince is very differently accounted for: "To Lord Mariſchal Mr Fletcher explained the motives which firſt induced him to join, and afterwards abandon, the duke of Monmouth. The former he aſcribed to the duke's manifeſto in Scotland relating to religion, and in England to liberty. For the latter he accounted by the diſguſt produced in his own mind and that of his aſſociates, when the duke declared himſelf king, and broke faith with all who embarked with him on his principles. He complained heavily of the account commonly given of the death of the mayor of Lynne; and mentioned to Lord Mariſchal, in proof of the contrary, that he did not leave the duke till he came to Taunton, where he was proclaimed king, ſeveral weeks after the death of the mayor of Lynne." *Memoirs of Great Britain and Ireland.*

Seeing all the efforts of himſelf and his friends in favour of liberty fruſtrated at Taunton, he endeavoured to ſecure his own perſonal freedom by taking his paſſage in the firſt ſhip bound to a foreign country. It was his misfortune to land in Spain; where he was immediately arreſted, caſt into priſon, and guarded by three

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Memoirs of the family of Salton. MS.

three different bands of soldiers, till a vessel should be prepared to carry him a victim in chains to the court of London. But in the morning before the ship could sail, whilst he looked pensive through the bars that secured the window of his room, he was hailed by a venerable personage who made signs to speak with him. The prison doors he found open; and whilst his friendly conductor waved to him to follow him, he passed through three different guards of soldiers all fast asleep. Without being permitted to offer his thanks to his deliverer, he found himself obliged to prosecute with all speed the journey, in which he was directed by a person concerning whom he could never collect any information; and in disguise he proceeded in safety through Spain. He felt a peculiar pleasure in relating to his friends instances of the care of Providence which he had experienced during his exile; and entertained them often with narratives of this kind, which he always mingled with religious reflections. Of these, another may be here mentioned. Happening in the evening to pass the skirt of a wood at a few miles distance from a city where he intended to lodge, he came to a place where two roads met. After he had entered upon the road on the right, he was accosted by a female of a respectable figure, who warned him to turn back, and take the road on the left; for that in the other there was danger which he could not escape if he continued to proceed. His friendly monitor suddenly retired into the wood, out of which she had issued no less unexpectedly. Having arrived at the city, the inhabitants were soon after alarmed by an account of the robbery and murder of several travellers who that evening had fallen into the hands of a banditti upon the very way in which he had intended to travel. From these and other instances of preservation from dangers, the devotion of his mind, habituated from his infancy to an intercourse with heaven, led him to conclude that he was in a peculiar manner the care of Providence, and that in critical cases his understanding received its direction from a supernatural impulse.

During his exile, he maintained a frequent and extensive correspondence with the friends of liberty at home; and he partly employed himself in making a curious collection of books, which compose the best private library in Scotland. But his genius also prompted him to engage in more active employments. He repaired to Hungary, and served several campaigns as a volunteer under the duke of Lorrain with great reputation. At length, understanding that the great design then projecting in Holland, and upon the issue of which he considered the liberties of Britain to be suspended, had attained a considerable degree of maturity, he hastened thither; where his councils and address were of eminent service. He came over with King William; and in zeal, activity, penetration, and political skill, proved inferior to none of the leaders in the Revolution.

Such, however, was his magnanimity, that from a survey of King William's papers it appears, that while others laboured to turn this grand event to the emolument of themselves and the aggrandisement of their family, Mr Fletcher asked nothing. His estate had been forfeited, and his house abandoned to military discretion; his fortune was greatly shattered, and his family reduced to circumstances of distress. Nothing was given him in recompense of all his sufferings. On the contrary, he, together with the duke of Hamilton, was distinguished by marks of royal and ministerial dislike. Still, whatever private resentment he might entertain, it appeared that his ruling principle was the good of his country; and that to this grand object of his heart he was willing to sacrifice all personal considerations. For when, in 1692, the abdicated king meditated an invasion, Mr Fletcher addressed a letter (preserved in Sir John Dalrymple's collection) to the duke of Hamilton, in which every argument is employed with skill and energy to engage his grace to forget his injuries, and in the present crisis to employ the extensive influence and authority he then possessed in the cause of freedom and of his country. This letter produced its full effect; and the duke returned to his duty, from which he had in part begun to deviate.

Fletcher

To follow our author through all the mazes of his political life subsequent to the Revolution, is beyond our purpose, and would exceed our limits. One or two circumstances more shall therefore suffice. Being elected a member for the parliament 1683, he showed an uniform zeal for the interest of his country. The thought of England's domineering over Scotland was what his generous soul could not endure. The indignities and oppression which Scotland lay under galled him to the heart; so that in his learned and elaborate discourses, he exposed them with undaunted courage and pathetical eloquence. In that great event, the Union, he performed essential service. He got the act of security passed, which declared that the two crowns should not pass to the same head till Scotland was secured in her liberties civil and religious. Therefore Lord Godolphin was forced into the Union, to avoid a civil war after the queen's demise. Although Mr Fletcher disapproved of some of the articles, and indeed of the whole frame of the Union; yet, as the act of security was his own work, he had all the merit of that important transaction.

We must not omit mentioning, that in the ardour of his political career Mr Fletcher forgot not the interests of the place that gave him birth. He esteemed the education of youth one of the noblest objects of government. On this subject he wrote a treatise, still extant, most characteristic of himself; and he established at Salton a foundation for the same purpose, of great utility while it lasted.

This great man died at London 1716, aged 66. His remains were conveyed to Scotland, and deposited in the family vault at Salton.

That Mr Fletcher received neither honours nor emoluments from King William, may perhaps be in part attributed to himself; a circumstance, however, which must add greatly to the lustre of his character. His uncomplying virtue, and the sternness of his principles, were ill calculated to conciliate courtly favour. He was so zealous an assertor of the liberties of the people, that he was too jealous of the growing power of all princes; in whom he thought ambition so natural, that he was not for trusting the best of kings with the power which ill ones might make use of against their subjects; he was of opinion that all princes were made by, and for the benefit of, the people; and that they should have no power but that of doing good. This,

which

Fletcher. which made him oppoſe King Charles and invade King James, led him alſo to oppoſe the giving ſo much power to King William, whom he would never ſerve after his eſtabliſhment. So we are told by the author of Short Political Characters, a MS. in the library of the late T. Rawlinſon, Eſq.—Mr Lockhart, in his Memoirs, p. 72. expreſſes a belief that his averſion to the Engliſh and to the Union was ſo great, that, in revenge to them, he was inclined to ſide with the abdicated family: "But (adds he) as that was a ſubject not fit to be entered upon with him, this is only a conjecture from ſome inuendos I have heard him make; but ſo far is certain, he liked, commended, and converſed with high-flying Tories, more than any other ſet of men; acknowledging them to be the beſt countrymen, and of moſt honour, integrity, and ingenuity." It ſeems difficult to reconcile this with Mr Fletcher's avowed principles and the general tenor of his conduct. May we ſuppoſe, that, chagrin, if not at the neglect or the ill treatment which he had himſelf received from government ſince the Revolution, yet at the public meaſures relating to his native country, might have occaſioned him to relent in his ſentiments with regard to the exiled family?—In the family memoirs already quoted, we are informed, That "Lord Mariſchal held Mr Fletcher's character in high admiration;" and that, "when governor of Neufchatel, where Rouſſeau reſided about the year 1766, he prevailed with this very extraordinary genius to write the life of a man whoſe character and actions he wiſhed to have tranſmitted to poſterity with advantage. For this purpoſe, his lordſhip applied to an honourable relation of Mr Fletcher's for materials; which by him were tranſmitted to Lord Mariſchal; but the deſign failed through Rouſſeau's deſultory and capricious diſpoſition." This anecdote muſt appear incompatible with the known loyalty and attachments of the Earl Mariſchal, unleſs we ſuppoſe him to have been privy to ſome ſuch ſentiments of Mr Fletcher as thoſe alluded to by Mr Lockhart; for how could we ſuppoſe him anxious to promote a compoſition, in which the taſk would be to celebrate principles diametrically oppoſite to his own, and to applaud actions ſubverſive of that royal family in whoſe cauſe he had ventured his life, and forfeited his fortune, and foregone his country!—But however theſe circumſtances may be reconciled, as the integrity, diſintereſtedneſs, and public ſpirit of Mr Fletcher, have been univerſally acknowledged, there is reaſon to believe, that all his ſentiments and actions were founded in honour, and that he never once purſued a meaſure further than he judged it to be for the intereſt of his country.

Mr Fletcher was maſter of the Engliſh, Latin, Greek, French, and Italian languages; and well verſed in hiſtory, the civil law, and all kinds of learning. In his travels, he had not only acquired conſiderable knowledge in the art of war, but alſo became verſant in the reſpective intereſts of the ſeveral princes and ſtates of Europe. In private life, he was affable to his friends, and free from all manner of vice. He had a penetrating, clear, and lively apprehenſion; but is ſaid to have been too much wedded to opinions, and impatient of contradiction.—He poſſeſſed an uncommon elevation of mind, accompanied with a warmth of temper, which would ſuffer him to brook from no rank among men, nor in any place, an indignity. Of this he exhibited a ſingular proof in the Scots parliament. The earl of Stair, ſecretary of ſtate and miniſter for Scotland, having in the heat of debate uſed an improper expreſſion againſt Mr Fletcher, he ſeized him by his robe, and inſiſted upon public and immediate ſatisfaction. His lordſhip was obliged inſtantly to beg his pardon in preſence of parliament. Fletewood || Flight.

Mr Fletcher was by far the fineſt ſpeaker in the parliament of Scotland; the earl of Stair alone rivalled him. The latter was famed for a ſplendid, the former for a cloſe and nervous, eloquence. He formed his ſtyle on the models of antiquity; and the ſmall volume of his works, Sir John Dalrymple obſerves, though imperfectly collected, is one of the very few claſſical compoſitions in the Engliſh language.

FLETEWOOD, William, an eminent Engliſh lawyer and recorder of London, in the reign of Queen Elizabeth. He was very zealous in ſuppreſſing maſs-houſes, and committing Popiſh prieſts; but once ruſhing in upon maſs at the Portugueſe ambaſſador's houſe, he was committed to the Fleet for breach of privilege, but ſoon releaſed. Mr Wood ſays, "He was a learned man, and a good antiquary, but of a marvellous merry and pleaſant conceit." He was a good popular ſpeaker, and wrote well upon ſubjects of government. His principal works are, 1. *Annalium tam regum Edwardi V. Richardi III. et Henrici VII. quam Henrici VIII.* 2. A Table of the Reports of Edmund Plowden. 3. The Office of a Juſtice of Peace. He died about the year 1593.

FLEVILLEA, a genus of plants belonging to the dioecia claſs. See Botany *Index*.

FLEURI, Claude, an able French critic and hiſtorian, was born at Paris in 1640. He applied himſelf to the law, was made advocate for the parliament of Paris, and attended the bar nine years; he then entered into orders, and was made preceptor to the princes of Conti. In 1689, the king made him ſub-preceptor to the dukes of Burgundy, Anjou, and Berry; and in 1706, when the education of theſe young princes was completed, the king gave him the priory of Argenteville belonging to the Benedictines in the dioceſe of Paris. In 1716, he was choſen counſellor to Louis XV. and died in 1723. He was the author of a great number of eſteemed French works; the principal of which are, 1. An eccleſiaſtical hiſtory, in 20 volumes, the laſt of which ends with the year 1414. 2. The manners of the Iſraelites and Chriſtians. 3. Inſtitutions of eccleſiaſtical law. 4. An hiſtorical catechiſm. 5. On the choice and method of ſtudy. 6. The duties of maſters and ſervants, &c.

FLEXIBLE, in *Phyſics*, a term applied to bodies capable of being bent or diverted from their natural figure or direction.

FLEXOR, in *Anatomy*, a name applied to ſeveral muſcles, which are ſo called from their office, which is to bend the parts to which they belong; in oppoſition to the *extenſors*, which open or ſtretch them. See Anatomy, *Table of the Muſcles*.

FLIGHT, the act of a bird in flying; or the manner, duration, &c. thereof.

Almoſt every kind of bird has its particular flight; the eagle's flight is the higheſt; the flight of the ſparrow-hawk and vulture is noble, and fit for high enter-

Flight, Flint.

priſe and combat. The flight of ſome birds is low, weak, and tranſient; the flight of the partridge and pheaſant is but of ſhort continuance; that of the dove is laboured; that of the ſparrow undulatory, &c.

The augurs pretended to foretel future events from the flight of birds. See AUGURY.

FLIGHT. In melting the lead ore in the works at Mendip, there is a ſubſtance which flies away in the ſmoke which is called the flight. The workmen find it ſweetiſh upon their lips, if their faces happen to be in the way of the ſmoke, which they avoid as much as poſſible. This, falling on the graſs, kills cattle that feed thereon; and, being gathered, and carried home, kills rats and mice in their houſes; that which falls on the ſand, they gather, and melt upon a flag hearth into ſhot and ſheet lead.

FLINT, a ſpecies of ſimple ſtones, chiefly compoſed of ſiliceous earth. See MINERALOGY *Index*.

Breaking of FLINTS. The art of cutting, or rather breaking, flint ſtones into uniform figures, is by ſome ſuppoſed to be one of the arts now loſt. That it was known formerly, appears from the ancient Bridewell at Norwich, from the gate of the Auguſtin friars at Canterbury, that of St John's Abbey at Colcheſter, and the gate near Whitehall, Weſtminſter. But that the art is not loſt, and that the French know it, appears from the platform on the top of the royal obſervatory at Paris; which, inſtead of being leaded, is paved with flint cut or broken into regular figures.

Gun FLINTS. For the method of manufacturing, ſee MINERALOGY *Index*.

FLINTS, in the glaſs trade. The way of preparing flints for the niceſt operations in the glaſs trade is this. Chooſe the hardeſt flints, ſuch as are black and will reſiſt the file, and will grow white when calcined in the fire. Cleanſe theſe of the white cruſt that adheres to them, then calcine them in a ſtrong fire, and throw them while red-hot into cold water; waſh off the aſhes that may adhere to them, and powder them in an iron mortar, and ſift them through a very fine ſieve; pour upon this powder ſome weak aquafortis, or the phlegm of aquafortis, to diſſolve and take up any particles of iron it may have got from the mortar; ſtir this mixture ſeveral times, then let it reſt, and in the morning pour off the liquor, and waſh the powder ſeveral times with hot water and afterwards dry it for uſe. You will thus have a powder for making the pureſt glaſs as perfectly fine and faultleſs as if you had uſed rock-cryſtal itſelf.

The waſhing off the ferruginous particles with aquafortis is not neceſſary when the glaſs intended to be made is to be tinged with iron afterwards; but when meant to be a pure white, this is the method that will ſecure ſucceſs.

FLINT, the chief town of Flintſhire, in North Wales. It is commodiouſly ſeated on the river Dee; and is but a ſmall place, though it ſends one member to parliament. It was formerly noted for its caſtle, where Richard II. took ſhelter on his arrival from Ireland; but having quitted it, he was taken priſoner by the duke of Lancaſter. The caſtle now is in a ruinous condition. This caſtle ſtands cloſe to the ſea on a rock, which in various parts forms ſeveral feet of its foundation. It covers about three quarters of an acre. The aſſizes are ſtill held in the town. It is 195 miles north-weſt of London.

Flintſhire || Floating Bodies.

FLINTSHIRE, a county of Wales, bounded on the north-eaſt and eaſt by an arm of the ſea, which is properly the mouth of the river Dee; on the north-weſt by the Iriſh ſea; and on the ſouth-ſouth-weſt and weſt by Denbighſhire. It is the leaſt of all the counties in Wales, being but 33 miles in length and 9 in breadth. It is divided into five hundreds; in which are two market towns and 28 pariſhes, with 32,400 inhabitants. The greateſt part of this county lies in the dioceſe of St Aſaph, and the reſt belongs to that of Cheſter. It ſends two members to parliament, one for the county and one for Flint; and pays one part of the land tax. The air is cold, but healthful. It is full of hills, intermixed with a few valleys, which are very fruitful, producing ſome wheat and plenty of rye. The cows, though ſmall, yield a great quantity of milk in proportion to their ſize, and are excellent beef. The mountains are well ſtored with lead, coal, and mill-ſtones. This county alſo produces good butter, cheeſe, and honey; of which laſt the natives make metheglin, a wholeſome liquor much uſed in theſe parts.

FLIP, a ſort of ſailors drink, made of malt liquor, brandy, and ſugar mixed.

FLOAT, a certain quantity of timber bound together with rafters athwart, and put into a river to be conveyed down the ſtream; and even ſometimes to carry burdens down a river with the ſtream.

Float-Boards, thoſe boards fixed to water wheels of under-ſhot mills, ſerving to receive the impulſe of the ſtream, whereby the wheel is carried round. See the articles WHEEL and MILL.

It is no advantage to have too great a number of float-boards; becauſe, when they are all ſtruck by the water in the beſt manner that it can be brought to come againſt them, the ſum of all the impulſes will be but equal to the impulſe made againſt one float-board at right angles, by all the water coming out of the penſtock through the opening, ſo as to take place on the float-board. The beſt rule in this caſe is to have juſt ſo many, that each of them may come out of the water as ſoon as poſſible, after it has received and acted with its full impulſe. As to the length of the float-board, it may be regulated according to the breadth of the mill. See MILL.

Floats for Fiſhing. See *Fishing Floats*.

FLOATAGES, all things floating on the ſurface of the ſea or any water; a word much uſed in the commiſſions of water bailiffs.

FLOATING BODIES are thoſe which ſwim on the ſurface of a fluid, the moſt intereſting of which are ſhips and veſſels employed in war and commerce. It is known to every ſeaman, of what vaſt moment it is to aſcertain the ſtability of ſuch veſſels, and the poſitions they aſſume when they float freely on the ſurface of the water. To be able to accompliſh this, it is neceſſary to underſtand the principles on which that ſtability and theſe poſitions depend. This has been done with great ingenuity by Mr Atwood, of whoſe reaſoning the following is a ſummary account, taken from the Philoſophical Tranſactions for 1796.

A floating body is preſſed downwards by its own weight in a vertical line paſſing through its centre of gravity; and it is ſupported by the upward preſſure of a fluid, which acts in a vertical line that paſſes through the centre of gravity of the part which is under the water;

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water; and without a coincidence between these two lines, in such a manner as that both centres of gravity may be in the same vertical line, the solid will turn on an axis, till it gains a position in which the equilibrium of floating will be permanent. From this it is obviously necessary to find what proportion the part immersed bears to the whole, to do which the specific gravity of the floating body must be known, after which it must be found by geometrical methods, in what positions the solid can be placed on the surface of the fluid, so that both centres of gravity may be in the same vertical line, when any given part of the solid is immersed under the surface. These things being determined, something is still wanting, for positions may be assumed in which the circumstances now mentioned concur, and yet the solid will assume some other position wherein it will permanently float. If the specific gravity of a cylinder be to that of the fluid on which it floats as 3 to 4, and its axis to the diameter of the base as 2 to 1: if it be placed on the fluid with its axis vertical, it will sink to a depth equal to a diameter and a half of the base; and while its axis is preserved in a vertical position by outward force, the centres of gravity of the whole solid and immersed part will remain in the same vertical line; but when the external force is removed, it will deviate from its upright position, and will permanently float with its axis horizontal. If we suppose the axis to be half the diameter of the base, and placed vertically, the solid will sink to the depth of three-eighths of its diameter, and in that position it will float permanently. If the axis be made to incline to the vertical line, the solid will change its position till it permanently settles with its axis perpendicular to the horizon.

Whether a solid floats permanently, or oversets when placed on the surface of a fluid, provided the centre of gravity of the solid and that of the immersed part be in the same vertical line, it is said to be in a position of equilibrium, of which there are three kinds; the equilibrium of stability, in which the solid permanently floats in a given position; the equilibrium of instability, in which the solid spontaneously oversets, if not supported by external force; and the equilibrium of indifference, or the insensible equilibrium, in which the solid rests on the fluid indifferent to motion, without tendency to right itself when inclined, or to incline farther.

If a solid body floats permanently on the surface of a fluid, and external force be applied to turn it from its position, the resistance opposed to this inclination is termed the *stability of floating*. Some ships at sea yield to a given impulse of the wind, and suffer a greater inclination from the perpendicular than others. As this resistance to heeling, duly regulated, has been considered of importance in the construction of vessels, many eminent mathematicians have laid down rules for ascertaining the stability of ships from their known dimensions and weight, without recurring to actual experiment. Bouguer, Euler, Chapman, and others, have laid down theorems for this purpose, founded on the supposition that the inclinations of ships from their quiescent positions are evanescent, or very small in a practical point of view. But ships at sea have been found to heel 10°, 20°, or 30°, and therefore it may be doubted how far such rules are applicable in practice. If statics can be applied to naval architecture, it seems necessary that the rules should be extended to those cases in which the angles of inclination are of any magnitude, likely to occur in the practice of navigation. A solid body placed on the surface of a lighter fluid, at such a depth as corresponds to the relative gravities, cannot alter its position by the joint action of its own weight and the pressure of the fluid, except by turning on some horizontal axis passing through the centre of gravity; but, as many axes may be drawn through this point of the floating body, in a direction parallel to the horizon, and the motion of the solid regards only one axis, this must be determined by the figure of the body and the particular nature of the case. When this axis of motion is ascertained, and the specific gravity of the solid found, the positions of permanent floating will be determined, by finding the several positions of equilibrium through which the solid may be conceived to pass, while it turns round the axis of motion; and by determining in which of these positions the equilibrium is permanent, and in which of them it is momentary.

The whole of Mr Atwood's valuable paper relates to the theory of naval architecture, in so far as it is dependent on the laws of pure mechanics. If the proportions and dimensions adopted in the construction of individual vessels are obtained by exact geometrical measurement, and observations are made on the performance of these vessels at sea; a sufficient number of experiments of this nature judiciously varied, are the proper grounds on which theory may be effectually applied, in reducing to system those hitherto unperceived causes, which contribute to give the greatest degree of excellence to vessels of every description. Naval architecture being reckoned among the practical branches of science, every voyage may be viewed in the light of an experiment, from which useful truths are to be deduced. But inferences of this nature cannot well be obtained, except by acquiring a thorough knowledge of all the proportions and dimensions of each part of the ship, and by making a sufficient number of observations on the qualities of the vessel, in all the varieties of situation to which a ship is commonly subject in the practice of navigation.

The following is an ingenious investigation of the same subject by Mr English, which we give in his own words.

"However operose and difficult (says he) the calculations necessary to determine the stability of nautical vessels may, in some cases, be, yet they all depend, says this author, upon the four following simple and obvious theorems, accompanied with other well known stereometrical and statical principles.

"*Theorem* 1. Every floating body displaces a quantity of the fluid in which it floats, equal to its own weight; and consequently, the specific gravity of the fluid will be to that of the floating body, as the magnitude of the whole is to that of the part immersed.

"*Theorem* 2. Every floating body is impelled downward by its own essential power, acting in the direction of a vertical line passing through the centre of gravity of the whole; and is impelled upward by the re-action of the fluid which supports it, acting in the direction of a vertical line passing through the centre of gravity of the part immersed; therefore, unless these two lines are coincident, the floating body thus impelled must revolve round an axis, either in motion or at rest, until the equilibrium is restored.

"*Theorem* 3. If by any power whatever a vessel be

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deflected from an upright position, the perpendicular distance between two vertical lines passing through the centres of gravity of the whole, and of the part immersed respectively, will be as the stability of the vessel, and which will be positive, nothing, or negative, according as the metacentre is above, coincident with, or below, the centre of gravity of the vessel.

"*Theorem* 4. The common centre of gravity of any system of bodies being given in position, if any one of these bodies be moved from one part of the system to another, the corresponding motion of the common centre of gravity, estimated in any given direction, will be to that of the aforesaid body, estimated in the same direction, as the weight of the body moved is to that of the whole system.

"From whence it is evident, that in order to ascertain the stability of any vessel, the position of the centres of gravity of the whole, and of that part immersed, must be determined; with which, and the dimensions of the vessel, the line of floatation, and angle of deflection, the stability or power either to right itself or overturn, may be found.

"In ships of war and merchandise, the calculations necessary for the purpose become unavoidably very operose and troublesome; but they may be much facilitated by the experimental method pointed out in the New Transactions of the Swedish Academy of Sciences, first quarter of the year 1787, page 48.

"In river and canal boats, the regularity and simplicity of the form of the vessel itself, together with the compact disposition and homogeneal quality of the burden, render that method for them unnecessary, and make the requisite calculations become very easy. Vessels of this kind are generally of the same transverse section throughout their whole length, except a small part in prow and stern, formed by segments of circles or other simple curves; therefore a length may easily be assigned such, that any of the transverse sections being multiplied thereby, the product will be equal to the whole solidity of the vessel. The form of the section ABCD is for the most part either rectangular, as in fig. 1. Plate CCXVIII. trapezoidal as in fig. 2. or mixtilineal as in fig. 3. in all which MM represents the line of floatation when upright, and EF that when inclined at any angle MXE; also G represents the centre of gravity of the whole vessel, and R that of the part immersed.

"If the vessel be loaded quite up to the line AB, and the specific gravity of the boat and burden be the same, then the point G is simply the centre of gravity of the section ABCD; but if not, the centres of gravity of the boat and burden must be found separately, and reduced to one by the common method, namely, by dividing the sum of the momenta by the sum of weights, or areas, which in this case are as the weights. The point R is always the centre of gravity of the section MMCD, which, if consisting of different figures, must also be found by dividing the sum of the momenta by the sum of the weights as common. These two points being found, the next thing necessary is to determine the area of the two equal triangles MXE, MXF, their centres of gravity *o*, *o*, and the perpendicular projected distance *n n* of these points on the water line EF. This being done, through R and parallel to EF draw RT=a fourth proportional to the whole area MMCD, either triangle MXE or MXF, and the distance *n n*; through T, and at right angles to RT or EF, draw TS meeting the vertical axis of the vessel in S the metacentre; also through the points G, B, and parallel to ST, draw NGW and BV; moreover through S, and parallel to EF, draw WSV, meeting the two former in V and W; then SW is as the stability of the vessel, which will be positive, nothing, or negative, according as the point S is above, coincident with, or below, the point G. If now we suppose W to represent the weight of the whole vessel and burden (which will be equal to the section MMCD multiplied by the length of the vessel), and P to represent the required weight applied at the gunwale B to sustain the vessel at the given angle of inclination; we shall always have this proportion: as VS : SW :: W : P; which proportion is general, whether SW be positive or negative; it must only in the latter case be supposed to act upward to prevent an overturn.

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"In the rectangular vessel, of given weight and dimensions, the whole process is so evident, that any farther explanation would be unnecessary. In the trapezoidal vessel, after having found the points G and R, let AD, BC be produced until they meet in K. Then, since the two sections MMCD, EFDC are equal; the two triangles MMK, EFK are also equal; and therefore the rectangle EK × KF = KM × KM = $\overline{KM}^2$; and since the angle of inclination is supposed to be known, the angles at E and F are given. Consequently, if a mean proportional be found between the sines of the angle at E and F, we shall have the following proportions:

"As the mean proportional thus found : sine ∠E :: KM : KF, and in the said mean proportional : sine ∠F:: KM : KE; therefore ME, MF become known; from whence the area of either triangle MXE or MXF, the distance *n n*, and all the other requisites, may be found.

"In the mixtilineal section, let AB = 9 feet = 108 inches, the whole depth = 6 feet = 72 inches, and the altitude of MM the line of floatation 4 feet or 48 inches; also let the two curvilinear parts be circular quadrants of two feet, or 24 inches radius each. Then the area of the two quadrants = 904·7808 square inches, and the distance of their centres of gravity from the bottom = 13·8177 inches very nearly; also the area of the included rectangle *a b i e* = 1440 square inches, and the altitude of its centre of gravity 12 inches; in like manner, the area of the rectangle AB *c d* will be found = 5184 square inches, and the altitude of its centre of gravity 48 inches: therefore we shall have

Momentum of the two quad.	= 904·7807	× 13·8177	= 12501·98966016
Moment. of the rectan. *a b i e*	= 1440·	× 12	= 17280·
Moment. of the rectan. AB *cd.*	= 5184·	× 48	= 248832·
	7528·7808		278613·98960016

"Now the sum of the momenta, divided by the sum of the areas, will give $\frac{278613{\cdot}98966016}{7528{\cdot}7808} = 37{\cdot}006$ inches, the altitude of G, the centre of gravity of the section

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section ABCD above the bottom. In like manner, the altitude of R, the centre of gravity of the section MMCD, will be found to be equal $\frac{123093.98966016}{4936.7808}$ = 24.934 inches; and consequently their difference, or the value of GR = 12.072 inches, will be found.

Suppose the vessel to heel 15°, and we shall have the following proportion; namely, As radius : tangent of 15° :: MX = 54 inches : 14.469 inches = ME or MF; and consequently the area of either triangle MXE or MXF = 390.663 square inches. Therefore, by theorem 4th, as 4936.7808 : 390.663 : : 72 = $n\,n$ = $\frac{2}{3}$ AB : 5.6975 inches = RT; and, again, as radius : sine of 15° : : 12.072 = GR : 3.1245 inches = RN; consequently RT—RN = 5.6975—3.1245 = 2.573 inches = SW, the stability required.

"Moreover, as the sine of 15° : radius : : 5.6975 = RT : 22.013 = RS, to which, if we add 24.934, the altitude of the point R, we shall have 46.947 for the height of the metacentre, which taken from 72, the whole altitude, there remains 25.053; from which, and the half width = 54 inches, the distance BS is found = 59.529 inches very nearly, and the angle SBV = 80°—06′—42″; from whence SV = 58.645 inches.

Again: Let us suppose the mean length of the vessel to be 40 feet, or 480 inches, and we shall have the weight of the whole vessel equal to the area of the section MMCD = 4936.7808 multiplied by 480 = 2369654.784 cubic inches of water, which weighs exactly 85708 pounds avoirdupoise, allowing the cubic foot to weigh 62.5 pounds.

"And, finally, as SV : SW (*i. e.*) as 58.645 : 2.573 :: 85708 : 3760 +, the weight on the gunwale which will sustain the vessel at the given inclination. Therefore a vessel of the above dimensions, and weighing 38 tons 5 cwts. 28 lbs. will require a weight of 1 ton 13 cwts. 64 lbs. to make her incline 15°.

"In this example the deflecting power has been supposed to act perpendicularly on the gunwale at B; but if the vessel is navigated by sails, the centre velique must be found; with which and the angle of deflection, the projected distance thereof on the line SV may be obtained; and then the power calculated as above, necessary to be applied at the projected point, will be that part of the wind's force which causes the vessel to heel. And conversely, if the weight and dimensions of the vessel, the area and altitude of the sails, the direction and velocity of the wind be given, the angle of deflection may be found."*

* *Phil. Mag.* i. 393.

Floating Bridge. See Bridge.

Floce Paper. See Paper.

FLOOD, a deluge or inundation of waters. See Deluge.

Flood is also used in speaking of the tide. When the water is at lowest, it is called *ebb;* when rising, *young flood;* when at highest, *high flood;* when beginning to fall, *ebb water.*

Flood-mark, the mark which the sea makes on the shore at flowing water and the highest tide; it is also called *high-water mark.*

FLOOK of an anchor. See Anchor.

FLOOKING, among miners, a term used to express a peculiarity in the load of a mine. The load or quantity of ore is frequently intercepted in its course by the crossing of a vein of earth or stone, or some different metallic substance; in which case the load is moved to one side, and this transient part of the land is called a *flooking.* Floor.

FLOOR, in building, the underside of a room, or that part we walk on.

Floors are of several sorts; some of earth, some of brick, others of stone, others of boards, &c.

For brick and stone Floors, see Pavement.

For boarded Floors, it is observable that the carpenters never floor their rooms with boards till the carcass is set up, and also enclosed with walls, lest the weather should injure the flooring. Yet they generally rough-plane their boards for the flooring before they begin any thing else about the building, that they may set them by to dry and season, which is done in the most careful manner. The best wood for flooring is the fine yellow deal well seasoned, which when well laid, will keep its colour for a long while; whereas the white sort becomes black by often washing, and looks very bad. The joints of the boards are commonly made plain, so as to touch each other only; but, when the stuff is not quite dry, and the boards shrink, the water runs through them whenever the floor is washed, and injures the ceiling underneath. For this reason they are made with feather edges, so as to cover each other about half an inch, and sometimes they are made with grooves and tenons: and sometimes the joints are made with dove tails; in which case the lower edge is nailed down, and the next drove into it, so that the nails are concealed. The manner of measuring floors is by squares of 10 feet on each side, so that taking the length and breadth, and multiplying them together and cutting off two decimals, the content of a floor in square will be given. Thus 18 by 16 gives 288 or 2 squares and 88 decimal parts.

Earthen Floors, are commonly made of loam, and sometimes, especially to make malt on, of lime, and brook-sand, and gun dust, or anvil dust from the forge.

Ox blood and fine clay, tempered together, Sir Hugh Plat says, make the finest floor in the world.

The manner of making earthen floors for plain country habitations is as follows: Take two-thirds of lime, and one of coal ashes well sifted, with a small quantity of loam clay; mix the whole together, and temper it well with water, making it up into a heap: let it lie a week or ten days, and then temper it over again. After this, heap it up for three or four days, and repeat the tempering very high, till it become smooth, yielding, tough, and gluey. The ground being then levelled, lay the floor therewith about 2½ or 3 inches thick, making it smooth with a trowel: the hotter the season is, the better; and when it is thoroughly dried, it will make the best floor for houses, especially malt houses.

If any one would have their floors look better, let them take lime made of rag stones, well tempered with whites of eggs, covering the floor about half an inch thick with it, before the under-flooring is too dry. If this be well done, and thoroughly dried, it will look when rubbed with a little oil as transparent as metal or glass. In elegant houses, floors of this nature are made of stucco, or of plaster of Paris beaten and sifted, and mixed with other ingredients.

Flora, Florales.

Floor of a Ship, ſtrictly taken, is only ſo much of her bottom as ſhe reſts on when aground.

Such ſhips as have long, and withal broad floors, lie on the ground with moſt ſecurity, and are not apt to heel, or tilt on one ſide; whereas others, which are narrow in the floor, or in the ſea phraſe, *cranked by the ground*, cannot be grounded without danger of being overturned.

Floor Timbers, in a ſhip, are thoſe parts of a ſhip's timbers which are placed immediately acroſs the keel, and upon which the bottom of the ſhip is framed; to theſe the upper parts of the timbers are united, being only a continuation of floor timbers upwards.

FLORA, the reputed goddeſs of flowers, was, according to Lactantius, only a lady of pleaſure, who having gained large ſums of money by proſtituting herſelf, made the Roman people her heir, on condition that certain games called *Floralia* might be annually celebrated on her birth day. Some time afterwards, however, ſuch a foundation appearing unworthy the majeſty of the Roman people, the ſenate, to ennoble the ceremony, converted Flora into a goddeſs, whom they ſuppoſed to preſide over flowers; and ſo made it a part of religion to render her propitious, that it might be well with their gardens, vineyards, &c. But Voſſius (*de Idol.* lib. i. c. 12.) can by no means allow the goddeſs Flora to have been the courtezan above mentioned: he will rather have her a Sabine deity, and thinks her worſhip might have commenced under Romulus. His reaſon is, that Varro, in his fourth book of the Latin tongue, ranks Flora among the deities to whom Tatius king of the Sabines offered up vows before he joined battle with the Romans. Add, that from another paſſage in Varro it appears, that there were prieſts of Flora, with ſacrifices, &c. as early as the times of Romulus and Numa.

The goddeſs Flora was, according to the poets, the wife of Zephyrus. Her image in the temple of Caſtor and Pollux was dreſſed in a cloſe habit, and ſhe held in her hands the flowers of peaſe and beans: but the modern poets and painters have been more laviſh in ſetting off her charms, conſidering that no parts of nature offered ſuch innocent and exquiſite entertainment to the ſight and ſmell, as the beautiful variety which adorns, and the odour which embalms, the floral creation.

FLORALES LUDI, or FLORAL GAMES, in antiquity, were games held in honour of Flora, the goddeſs of flowers.—They were celebrated with ſhameful debaucheries. The moſt licentious diſcourſes were not enough, but the courtezans were called together by the ſound of a trumpet, made their appearance naked, and entertained the people with indecent ſhows and poſtures: the comedians appeared after the ſame manner on the ſtage. Val. Maximus relates, that Cato being once preſent in the theatre on this occaſion, the people were aſhamed to aſk for ſuch immodeſt repreſentations in his preſence; till Cato, appriſed of the reſervedneſs and reſpect with which he inſpired them, withdrew, that the people might not be diſappointed of their accuſtomed diverſion. There were ſeveral other ſorts of ſhows exhibited on this occaſion; and, if we may believe Suetonius in *Galba*, c. 6. and Vopiſcus in *Carinus*, theſe princes preſented elephants dancing on ropes on theſe occaſions. Floralia, Florence.

The ludi florales, according to Pliny, lib. xviii. c. 29. were inſtituted by order of an oracle of the Sibyls, on the 28th of April; not in the year of Rome DXVI. as we commonly read it in the ancient editions of that author; nor in DXIV. as F. Hardouin has corrected it, but, as Voſſius reads it, in 513: though they were not regularly held every year till after 580. They were chiefly held in the night time, in the Patrician ſtreet: ſome will have it there was a circus for the purpoſe on the hill called Hortulorum.

FLORALIA, in antiquity, a general name for the feaſts, games, and other ceremonies, held in honour of the goddeſs Flora. See FLORA and FLORALES *Ludi*.

FLORENCE, the capital of the duchy of Tuſcany, and one of the fineſt cities in Italy. It is ſurrounded on all ſides but one with high hills, which riſe inſenſibly, and at laſt join with the lofty mountains called the *Apennines*. Towards Piſa, there is a vaſt plain of 40 miles in length; which is ſo filled with villages and pleaſure houſes, that they ſeem to be a continuation of the ſuburbs of the city. Independent of the churches and palaces of Florence, moſt of which are very magnificent, the architecture of the houſes in general is in a good taſte; and the ſtreets are remarkably clean, and paved with large broad ſtones chiſeled ſo as to prevent the horſes from ſliding. The city is divided into two unequal parts by the river Arno, over which there are no leſs than four bridges in ſight of each other. That called the *Ponte della Trinità*, which is uncommonly elegant, is built entirely of white marble, and ornamented with four beautiful ſtatues repreſenting the Seaſons. The quays, the buildings on each ſide, and the bridges, render that part of Florence through which the river runs by far the fineſt. Every corner of this beautiful city is full of wonders in the arts of painting, ſtatuary, and architecture. The ſtreets, ſquares, and fronts of the palaces, are adorned with a great number of ſtatues; ſome of them by the beſt modern maſters, Michael Angelo, Bandinelli, Donatello, Giovanni di Bologna, Benvenuto Cellini, and others. Some of the Florentine merchants formerly were men of vaſt wealth, and lived in a moſt magnificent manner. One of them, about the middle of the fifteenth century, built that noble fabric, which, from the name of its founder, is ſtill called the *Palazzo Pitti*. The man was ruined by the prodigious expence of this building, which was immediately purchaſed by the Medici family, and has continued ever ſince to be the reſidence of the ſovereigns. The gardens belonging to this palace are on the declivity of an eminence. On the ſummit there is a kind of fort, called *Belvedere*. From this, and from ſome of the higher walks, you have a complete view of the city of Florence, and the beauteous vale of Arno, in the middle of which it ſtands. This palace has been enlarged ſince it was purchaſed from the ruined family of Pitti. The furniture is rich and curious, particularly ſome tables of Florentine work, which are much admired. The moſt precious ornaments, however, are the paintings. The walls of what is called the *Imperial Chamber*, are painted in freſco, by various painters; the ſubjects are allegorical, and in honour of Lorenzo of Medicis diſtinguiſhed

Florence. ſtinguiſhed by the name of the *Magnificent*. The famous gallery attracts every ſtranger. One of the moſt intereſting parts of it, in the eyes of many, is the ſeries of Roman emperors, from Julius Cæſar to Gallienus, with a conſiderable number of their empreſſes, arranged oppoſite to them. This ſeries is almoſt complete; but wherever the buſt of an emperor is wanting, the place is filled up by that of ſome other diſtinguiſhed Roman. The celebrated Venus of Medici, which has been removed to Paris, is thought to be the ſtandard of taſte in female beauty and proportion, and ſtood formerly in a room called the *Tribunal*. The inſcription on its baſe mentions its being made by Cleomenes an Athenian, the ſon of Apollodorus. It is of white marble, and ſurrounded by other maſterpieces of ſculpture, ſome of which are ſaid to be the works of Praxiteles and other Greek maſters. In the ſame room are many valuable curioſities, beſides a collection of admirable pictures by the beſt maſters. There are various other rooms, whoſe contents are indicated by the names they bear; as, the Cabinet of Arts, of Aſtronomy, of Natural Hiſtory, of Medals, of Porcelain, of Antiquities; the Saloon of the Hermaphrodite, ſo called from a ſtatue which divides the admiration of the amateurs with that in the Borgheſe villa at Rome, though the excellence of the execution is diſgraced by the vileneſs of the ſubject; and the Gallery of Portraits, which contains the portraits of the moſt eminent painters (all executed by themſelves) who have flouriſhed in Europe during the three laſt centuries. Our limits will not admit of a detail of the hundredth part of the curioſities and buildings of Florence. We muſt not however omit mentioning the chapel of St Lorenzo, as being perhaps the fineſt and moſt expenſive habitation that ever was reared for the dead; it is incruſted with precious ſtones, and adorned by the workmanſhip of the beſt modern ſculptors. Mr Addiſon remarked, that this chapel advanced ſo very ſlowly, that it is not impoſſible that the family of Medicis may be extinct before their burial place is finiſhed. This has actually taken place: the Medici family is extinct, and the chapel remains ſtill unfiniſhed.

Florence is a place of ſome ſtrength, and contains an archbiſhop's ſee and an univerſity. The number of inhabitants is calculated at 80,000. They boaſt of the improvements they have made in the Italian tongue, by means of their Academia della Cruſca; and ſeveral other academies are now eſtabliſhed at Florence. Though the Florentines affect great ſtate, yet their nobility and gentry drive a retail trade in wine, which they ſell from their cellar windows, and ſometimes they even hang out a broken flaſk, as a ſign where it may be bought. They deal, beſides wine and fruits, in gold and ſilver ſtuffs. The Jews are not held in that degree of odium, or ſubjected to the ſame humiliating diſtinctions here, as in moſt other cities of Europe; and it is ſaid that ſome of the richeſt merchants are of that religion.

As to the manners and amuſements of the inhabitants, Dr Moore informs us, that "beſides the *converſazionis* which they have here, as in other towns of Italy, a number of the nobility meet every day at a houſe called the *Caſino*. This ſociety is pretty much on the ſame footing with the clubs in London. The members are elected by ballot. They meet at no particular hour, but go at any time that is convenient. They play at billiards, cards, and other games, or continue converſing the whole evening, as they think proper. They are ſerved with tea, coffee, lemonade, ices, or what other refreſhments they chooſe; and each perſon pays for what he calls for. There is one material difference between this and the Engliſh clubs, that women as well as men are members. The company of both ſexes behave with more frankneſs and familiarity to ſtrangers as well as to each other, than is cuſtomary in public aſſemblies in other parts of Italy. The opera is a place where the people of quality pay and receive viſits, and converſe as freely as at the Caſino above mentioned. This occaſions a continual paſſing and repaſſing to and from the boxes, except in thoſe where there is a party of cards formed; it is then looked on as a piece of ill manners to diſturb the players. From this it may be gueſſed, that here, as in ſome other towns in Italy, little attention is paid to the muſic by the company in the boxes, except at a new opera, or during ſome favourite air. But the dancers command a general attention: as ſoon as they begin, converſation ceaſes; even the card-players lay down their cards, and fix their eyes on the *ballette*. Yet the excellence of Italian dancing ſeems to conſiſt in feats of ſtrength, and a kind of jerking agility, more than in graceful movement. There is a continual conteſt among the performers, who ſhall ſpring higheſt. You ſee here none of the ſprightly alluring gaiety of the French comic dancers, or of the graceful attitudes and ſmooth flowing motions of the performers in the ſerious opera at Paris. It is ſurpriſing that a people of ſuch taſte and ſenſibility as the Italians, ſhould prefer a parcel of athletic jumpers to elegant dancers. On the evenings on which there is no opera, it is uſual for the genteel company to drive to a public walk immediately without the city, where they remain till it begins to grow duſkiſh." E. Long. 12. 24. N. Lat. 43. 34. Florence || Florida.

FLORENCE, an ancient piece of Engliſh gold coin. Every pound weight of ſtandard gold was to be coined into 50 Florences to be current at ſix ſhillings each; all which made in tale 15 pounds; or into a proportionate number of half Florences, or quarter pieces, by indenture of the mint: 18 Edw. III.

FLORENTIA, in *Ancient Geography*, a town of Etruria, on the Arnus; of great note in Sylla's wars. Now called *Florenza* or *Firenza* by the Italians; *Florence* in Engliſh. E. Long. 11. Lat. 43. 30.

FLORENTINE MARBLE. See CITADANESCA.

FLORESCENTIA (from *floreſco*, "to flouriſh or bloom"); the act of flowering, which Linnæus and the ſexualiſts compare to the act of generation in animals; as the ripening of the fruit in their opinion reſembles the birth. See FLOWER.

FLORID STYLE, is that too much enriched with figures and flowers of rhetoric.

FLORIDA, the moſt ſouthern province of the Britiſh empire in America before the laſt war, bounded on the ſouth by the gulf of Mexico, on the north by the Apalachian mountains, on the eaſt by the province of Georgia, and on the weſt by the river Miſſiſſippi. It was firſt diſcovered, in 1497, by Sebaſtian Cabot, a Venetian, then in the Engliſh ſervice; whence a right to the country was claimed by the kings of England; and this province, as well as Georgia, was included in the charter granted by Charles II. to Carolina.

Florida. rolina. In 1512, however, Florida was more fully discovered by Ponce de Leon, an able Spanish navigator, but who undertook his voyage from the most absurd motives that can be well imagined.—The Indians of the Caribbee islands had among them a tradition, that somewhere on the continent there was a fountain whose waters had the property of restoring youth to all old men who tasted them. The romantic imaginations of the Spaniards were delighted with this idea. Many embarked in voyages to find out this imaginary fountain, who were never afterwards heard of. Their superstitious countrymen never imagined that these people had perished. They concluded that they did not return, only because they had drunk of the immortalizing liquor, and had discovered a spot so delightful, that they did not choose to leave it. Ponce de Leon set out with this extravagant view as well as others, and fully persuaded of the existence of a third world, the conquest of which was to immortalize his name. In the attempt to discover this country, he rediscovered Florida; but returned to the place from whence he came, visibly more advanced in years than when he set out. For some time this country was neglected by the Spaniards, and some Frenchmen settled in it: But the new colony being neglected by the ministry, and Philip II. of Spain having accustomed himself to think that he was the sole proprietor of America, fitted out a fleet at Cadiz to destroy them. His orders were executed with barbarity. The French intrenchments were forced, and most of the people killed. The prisoners were hanged on trees; with this inscription, "Not as Frenchmen, but as Heretics."

This cruelty was soon after revenged by Dominic de Gourgues, a skilful and intrepid seaman of Gascony, an enemy to the Spaniards, and passionately fond of hazardous expeditions and of glory. He sold his estate; built some ships; and with a select band of adventurers like himself embarked for Florida. He drove the Spaniards from all their posts with incredible valour and activity; defeated them in every rencounter: and by way of retaliation, hung the prisoners on trees. with this inscription, "Not as Spaniards, but as Assassins." This expedition was attended with no other consequences; Gourgues blew up the forts he had taken, and returned home, where no notice was taken of him. It was conquered in 1539 by the Spaniards under Ferdinand de Soto, not without a great deal of bloodshed; as the natives were very warlike and made a vigorous resistance. The settlement, however, was not fully established till the year 1565; when the town of St Augustine, the capital of the colony while it remained in the hands of the Spaniards, was founded. In 1586, this place was taken and pillaged by Sir Francis Drake. It met with the same fate in 1665, being taken and plundered by Captain Davis and a body of bucaniers. In 1702, an attempt was made upon it by Colonel More, governor of Carolina. He set out with 500 English and 700 Indians: and having reached St Augustine, he besieged it for three months; at the expiration of which, the Spaniards having sent some ships to the relief of the place, he was obliged to retire. In 1740 another attempt was made by General Oglethorpe; but he being outwitted by the Spanish governor, was forced to raise the siege with loss; and Florida continued in the hands of the Spaniards till the year 1763, when it was ceded by treaty to Great Britain.—During the American war, which terminated in 1783, it was again reduced by his Catholic majesty, and was guaranteed to the crown of Spain at the peace. Florilegium || Florist.

FLORILEGIUM, FLORILEGE, a name the Latins have given to what the Greeks call *ανθολογιον, anthology;* viz. a collection of choice pieces, containing the finest and brightest things in their kind.

FLORILEGE, is also particularly used for a kind of breviary, in the Eastern church, compiled by Arcadius, for the conveniency of the Greek priests and monks, who cannot carry with them, in their travels and pilgrimages, all the volumes wherein their office is dispersed. The florilegium contains the general rubrics, psalter, canticles, the horologium, and the office of the feriæ, &c.

FLORIN, is sometimes used for a coin, and sometimes for a money of account.

Florin, as a coin, is of different values, according to the different metals and different countries where it is struck. The gold florins are most of them of a very coarse alloy, some of them not exceeding thirteen or fourteen carats, and none of them seventeen and a half. See *Money Table.*

Florin, as a money of account, is used by the Italian, Dutch, and German merchants and bankers, but admits of divisions in different places. Ibid.

FLORINIANI, or FLORIANI, a sect of heretics, of the second century, denominated from its author Florinus, or Florianus, a priest of the Roman church, deposed along with Blastus for his errors. Florinus had been a disciple of St Polycarp, along with Irenæus. He made God the author of evil; or rather asserted, that the things forbidden by God are not evil, but of his own appointing. In which he followed the errors of Valentinus, and joined himself with the Carpocratians. They had also other names given them. Philastrius says, they were the same with the *Carpophorians.* He adds that they were also called *soldiers, milites, quia de militaribus fuerunt.* St Irenæus calls them *Gnostics;* St Epiphanius *Phibionites;* and Theodoret, *Barborites,* on account of the impurities of their lives. Others call them *Zaccheans;* others *Coddians,* &c. though for what particular reasons, it is not easy to say, nor perhaps would be worth while to inquire.

FLORIS, FRANCIS, an eminent historical painter, was born at Antwerp in 1520. He followed the profession of a statuary till he was twenty years of age; when preferring painting, he entered the school of Lambert Lombard, whose manner he imitated very perfectly. He afterwards went to Italy, and completed his studies from the most eminent masters. The great progress he made in historical painting, at his return procured him much employment; and his countrymen complimented him with the flattering appellation of *the Flemish Raphael.* He got much money, and might have rendered his acquaintance more worthy of the attention of the great, had he not debased himself by frequent drunkenness. He died 1570, aged 50.

FLORIST, a person curious or skilled in flowers; their kinds, names, characters, culture, &c. It is also applied to an author who writes what is called the flora

Florus || Flotſon.

flora of any particular place, that is, a catalogue of the plants and trees which are found ſpontaneouſly growing there.

FLORUS, Lucius Annæus, a Latin hiſtorian, of the ſame family with Seneca and Lucan. He flouriſhed in the reigns of Trajan and Adrian; and wrote an abridgment of the Roman hiſtory, of which there have been many editions. It is compoſed in a florid and poetical ſtyle; and is rather a panegyric on many of the great actions of the Romans, than a faithful and correct recital of their hiſtory. He alſo wrote poetry, and entered the liſts againſt the emperor Adrian, who ſatirically reproached him with frequenting taverns and places of diſſipation.

FLORY, Flowery, or *Fleury*, in *Heraldry*, a croſs that has flowers at the end circumflex and turning down; different from the *potence*, in as much as the latter ſtretches out more like that which is called *patce*.

FLOS, Flower. See Flower, Botany *Index*.

Fœmineus Flos, a flower which is furniſhed with the pointal or female organs of generation, but wants the ſtamina or male organ. Female flowers may be produced apart from the male, either on the ſame root or on diſtinct plants. Birch and mulberry are examples of the firſt caſe, willow and poplar of the ſecond.

Maſculus Flos, a male flower. By this name Linnæus and the ſexualiſts diſtinguiſh a flower which contains the ſtamen, reckoned by the ſexualiſts the male organ of generation; but not the ſtigma or female organ. All the plants of the claſs dioecia of Linnæus have male and female flowers upon different roots; thoſe of the claſs monœcia bear flowers of different ſexes on the ſame root. The plants, therefore of the former are only male and female: thoſe of the latter are androgynous; that is, contain a mixture of both male and female flowers.

Flos, in *Chemiſtry*, the moſt ſubtile part of bodies ſeparated from the more groſs parts by ſublimation in a dry form.

FLOTA, or Flotta, *fleet;* a name the Spaniards give particularly to the ſhips which they ſend annually from Cadiz to the port of Vera Cruz, to fetch thence the merchandiſes gathered in Mexico for Spain. It conſiſts of the captains, admiral, and patach, or pinnace, which go on the king's account; and about 16 ſhips, from 400 to 1000 tons, belonging to particular perſons. They ſet out from Cadiz about the month of Auguſt, and are 18 or 20 months before they return. Thoſe ſent to fetch the commodities prepared in Peru are called *galleons*.

The name *flotilla* is given to a number of ſhips, which get before the reſt in their return, and give information of the departure and cargo of the flota and galleons.

FLOTSON, or Flotsom, goods that by ſhipwreck are loſt, and floating upon the ſea; which, with jetſon and lagan, are generally given to the lord admiral: but this is the caſe only where the owners of ſuch goods are not known. And here it is to be obſerved, that *jetſon* ſignifies any thing that is caſt out of a ſhip when in danger, and afterwards is beat on the ſhore by the water, notwithſtanding which the ſhip periſhes. *Logan* is where heavy goods are thrown overboard, before the wreck of the ſhip, and ſink to the bottom of the ſea.

Flounder || Flower.

FLOUNDER, Fluke, or *But*. See Pleuronectes, Ichthyology *Index*.

Flounders may be fiſhed for all day long, either in a ſwift ſtream, or in the ſtill deep water; but beſt in the ſtream in the months of April, May, June, and July: the moſt proper baits are all ſorts of worms, waſps, and gentles.

FLOUR, the meal of wheat-corn, finely ground and ſifted. See Meal.

The grain itſelf is not only ſubject to be eaten by inſects in that ſtate; but, when ground into flour, it gives birth to another race of deſtroyers, who eat it unmercifully, and increaſe ſo faſt in it, that it is not long before they wholly deſtroy the ſubſtance. The fineſt flour is moſt liable to breed theſe, eſpecially when ſtale or ill prepared. In this caſe, if it be examined in a good light, it will be obſerved to be in continual motion, and on a nicer inſpection there will be found in it a great number of little animals of the colour of the flour, and very nimble. If a little of this flour is laid on the plate of the double microſcope, the inſects are very diſtinctly ſeen in great numbers, very briſk and lively, continually crawling over one another's backs, and playing a thouſand antic tricks together; whether in diverſion, or in ſearch of food, is not eaſy to be determined. Theſe animals are of an oblong and ſlender form; their heads are furniſhed with a kind of trunk or hollow tube, by means of which they take in their food, and their body is compoſed of ſeveral rings. They do vaſt miſchief among magazines of flour laid up for armies and other public uſes. When they have once taken poſſeſſion of a parcel of this valuable commodity, it is impoſſible to drive them out; and they increaſe ſo faſt, that the only method of preventing the total loſs of the parcel is to make it up into bread as ſoon as can be done. The way to prevent their breeding in the flour is to preſerve it from damp: nothing gets more injury by being put up damp than flour; and yet nothing is more frequently put up ſo. It ſhould be always carefully and thoroughly dried before it is put up, and the barrels alſo dried into which it is to be put; then, if they are placed in a room tolerably warm and dry, they will keep it well. Too dry a place never does flour any hurt, though one too moiſt almoſt always ſpoils it.

Flour when carefully analyzed, is found to be compoſed of three very different ſubſtances. The firſt and moſt abundant is pure *ſtarch*, or white fecule, inſoluble in cold, but ſoluble in hot water, and of the nature of mucous ſubſtances; which, when diſſolved, form water-glues. The ſecond is the *gluten*, moſt of whoſe properties have been deſcribed under the article Bread. The third is of a mild nature, perfectly ſoluble in cold water, of the nature of *ſaccharine* extractive mucous matters. It is ſuſceptible of the ſpirituous fermentation, and is found but in ſmall quantity in the flour of wheat. See Bread, Gluten, Starch, and Sugar, Chemistry *Index*.

FLOWER, Flos, among botaniſts and gardeners, the moſt beautiful part of trees and plants, containing the organs or parts of fructification. See Botany *Index*.

Flowers. Flowers, deſigned for medical uſe, ſhould be plucked when they are moderately blown, and on a clear day before noon: for conſerves, roſes muſt taken in the bud.

Flowers, in antiquity. We find flowers in great requeſt at the entertainments of the ancients, being provided by the maſter of the feaſt, and brought in before the ſecond courſe; or, as ſome are of opinion, at the beginning of the entertainment. They not only adorned their heads, necks, and breaſts, with flowers, but often beſtrewed the beds whereon they lay, and all parts of the room with them. But the head was chiefly regarded. See Garland.

Flowers were likewiſe uſed in the bedecking of tombs. See Burial.

Eternal Flower. See Xeranthemum,
Everlaſting Flower. See Gnaphalium,
Flower-Fence. See Poincian,
Sun-Flower. See Helianthus,
Sultan-Flower. See Cyanus,
Trumpet-Flower. See Bignonia,
Wind-Flower. See Anemone,
} Botany *Index*.

Flower-de-lis, or *Flower-de-luce*, in *Heraldry*, a bearing repreſenting the lily called the *queen of flowers*, and the true hieroglyphic of royal majeſty; but of late it is become more common, being borne in ſome coats one, in others three, in others five, and in ſome *ſemee* or ſpread all over the eſcutcheon in great numbers.

The arms of France are, three flowers-de-lis or, in a field azure.

Flower-de-Luce. See Iris, Botany *Index*.

Flowers, in *Heraldry*. They are much uſed in coats of arms; and in general ſignify hope, or denote human frailty and momentary proſperity.

Flowers, in *Chemiſtry*. By this name are generally underſtood bodies reduced into very fine parts, either ſpontaneouſly, or by ſome operation of art; but the term is chiefly applied to volatile ſolid ſubſtances, reduced into very fine parts, or into a kind of meal by ſublimation.—Some flowers are nothing elſe than the bodies themſelves, which are ſublimed entire, without ſuffering any alteration or decompoſition; and other flowers are ſome of the conſtituent parts of the body ſubjected to ſublimation.

Colours of Flowers. See the article *Colour* (*of Plants*).

Colours extracted from Flowers. See *Colour-Making*.

Preſerving of Flowers. The method of preſerving flowers in their natural beauty through the whole year has been much ſought after by many people. Some have attempted it by gathering them when dry and not too much opened, and burying them in dry ſand; but this, though it preſerves their figure well, takes off from the livelineſs of their colour. Muntingius prefers the following method to all others. Gather roſes, or other flowers, when they are not yet thoroughly open, in the middle of a dry day; fill the veſſel up to the top with them; and when full ſprinkle them over with ſome good French wine, with a little ſalt in it; then ſet them by in a cellar, tying down the mouth of the pot. After this they may be taken out at pleaſure; and, on ſetting them in the ſun, or within reach of the fire, they will open as if growing naturally; and not only the colour, but the ſmell alſo will be preſerved. Flowers.

The flowers of plants are by much the moſt difficult parts of them to preſerve in any tolerable degree of perfection; of which we have inſtances in all the collections of dried plants, or *horti ſicci*. In theſe the leaves, ſtalks, roots, and ſeeds of the plants, appear very well preſerved; the ſtrong texture of theſe parts making them always retain their natural form, and the colours in many ſpecies naturally remaining. But where theſe fade, the plant is little the worſe for uſe as to the knowing the ſpecies by it. But it is very much otherwiſe in regard to flowers; theſe are naturally by much the moſt beautiful parts of the plants to which they belong; but they are ſo much injured in the common way of drying, that they not only loſe, but change their colours one into another, by which means they give a handle to many errors; and they uſually alſo wither up, ſo as to loſe their very form and natural ſhape. The primroſe and cowſlip kinds are very eminent inſtances of the change of colours in the flowers of dried ſpecimens; for thoſe of this claſs of plants eaſily dry in their natural ſhape; but they loſe their yellow, and, inſtead of it, acquire a fine green colour, much ſuperior to that of the leaves in their moſt perfect ſtate. The flowers of all the violet kind loſe their beautiful blue, and become of a dead white: ſo that in dried ſpecimens there is no difference between the blue-flowered violet and the white-flowered kinds.

Sir Robert Southwell has communicated to the world a method of drying plants, by which this defect is propoſed to be in a great meaſure remedied, and all flowers preſerved in their natural ſhape, and many in their natural colours.—For this purpoſe two plates of iron are to be prepared of the ſize of a large half ſheet of paper, or larger, for particular occaſions; theſe plates muſt be made ſo thick as not to be apt to bend: and there muſt be a hole made near every corner for the receiving a ſcrew to faſten them cloſe together. When theſe plates are prepared, lay in readineſs ſeveral ſheets of paper, and then gather the plants with their flowers when they are quite perfect. Let this be always done in the middle of a dry day; and then lay the plant and its flower on one of the ſheets of paper doubled in half, ſpreading out all the leaves and petals as nicely as poſſible. If the ſtalk is thick, it muſt be pared or cut in half, ſo that it may lie flat; and if it is woody, it may be peeled, and only the bark left. When the plant is thus expanded, lay round about it ſome looſe leaves and petals of the flower, which may ſerve to complete any part that is deficient. When all is thus prepared, lay ſeveral ſheets of paper over the plant, and as many under it; then put the whole between the iron plates, laying the papers ſmoothly on one, and laying the other evenly over them; ſcrew them cloſe, and put them into an oven after the bread is drawn, and let them lie there two hours. After that, make a mixture of equal parts of aquafortis and common brandy; ſhake theſe well together, and when the flowers are taken out of the preſſure of the plates, rub them lightly over with a camel's hair pencil dipped in this liquor; then lay them upon freſh brown paper, and covering them with ſome other ſheets, preſs them between this and other papers with a handkerchief till the

Flowers, Flowering.

the wet of these liquors is dried wholly away. When the plant is thus far prepared, take the bulk of a nutmeg of gum dragon; put this into a pint of fair water cold, and let it stand 24 hours; it will in this time be wholly dissolved: then dip a fine hair pencil in this liquor, and with it daub over the back sides of the leaves, and lay them carefully down on half a sheet of white paper fairly expanded, and press them down with some more papers over these. When the gum-water is fixed, let the presser and papers be removed, and the whole work is finished. The leaves retain their verdure in this case, and the flowers usually keep their natural colours. Some care, however, must be taken, that the heat of the oven be not too great. When the flowers are thick and bulky, some art may be used to pare off their backs, and dispose the petals in a due order; and after this, if any of them are wanting, their places may be supplied with some of the supernumerary ones dried on purpose; and if any of them are only faded, it will be prudent to take them away, and lay down others in their stead: the leaves may be also disposed and mended in the same manner.

Another method of preserving both flowers and fruit found throughout the whole year is also given by the same author. Take saltpetre, one pound; Armenian bole, two pounds; clean common sand, three pounds: mix all well together. Then gather fruit of any kind that is not fully ripe, with the stalk to each; put these in, one by one, into a wide-mouthed glass, laying them in good order. Tie over the top with an oil-cloth, and carry them into a dry cellar, and set the whole upon a bed of the prepared matter of four inches thick in a box. Fill up the remainder of the box with the same preparation; and let it be four inches thick all over the top of the glass, and all round its sides. Flowers are to be preserved in the same sort of glasses, and in the same manner; and they may be taken up after a whole year as plump and fair as when they were buried.

Artificial FLOWERS of the Chinese. See TONG-TSAO.

FLOWERS, in the animal economy, denote women's monthly purgations or menses.—Nicod derives the word in this sense, from *fluere*, q. d. *fluors*. Others will have the name occasioned hence, that women do not conceive till they have had their flowers; so that these are a sort of forerunners of their fruit.

FLOWERS, in *Rhetoric*, are figures or ornaments of discourse, by the Latins called *flosculi*.

FLOWERING *of Bulbous* PLANTS. These plants will grow and flower in water alone, without any earth, and make a very elegant appearance. We daily see this practised in single roots; but there is a method of doing it with several roots in the same vessel. Take a common small garden pot; stop the hole at the bottom with a cork, and lute in the cork with putty, that no water can get through; then fit a board to the top of the pot, and bore six or seven holes in it at equal distances, to place the bulbs in; and as many smaller ones near them to receive sticks, which will serve to tie up the flowers. Then fill up the pot with water to the board; and place tulips, jonquils, narcissuses, and the like plants in the root upon the holes, so that the bottom of the roots may touch the water: thus will they all flower early in the season, and be much more beautiful than any pot of gathered flowers, and will last many weeks in their full perfection. After the season of flowering is over, the roots will gradually shrink through the holes of the board, and get loose into the water: but, instead, of being spoiled there, they will soon increase in size; so that they cannot return through the holes, and will produce several offsets. It is natural to try from this the consequence of keeping the roots under water during the whole time of their blowing; and in this way they have been found to succeed very well, and flower even stronger and more beautifully than when in the ground. They may thus, also, with proper care in the degree of heat in the room, be kept flowering from before Christmas till March or April. It is not easy, in this last manner, to manage the keeping the boards under water, for which reason, it is better to procure some sheet-lead of about four pounds to the foot, and cut this to the size of the mouth of the pot. In this there should be bored holes for the bulbs, and other holes for the sticks: and, in order to keep the sticks quite firm, it is proper to have another plate of lead shaped to the bottom of the pot, with holes in it, answering to those of the upper plate made for the sticks. The sticks will by this means be always kept perfectly steady; and the roots, being kept under water by the upper plate of lead, will flower in the most vigorous and beautiful manner imaginable. Some have thought of adding to the virtues of the water by putting in nitre in small quantities, and others have added earth and sand at the bottom; but it has always been found to succeed better without any addition.

Flowering.

It may be more agreeable to some to use glass jars in this last method with the leads, instead of earthen pots. The bulbs succeed full as well in these; and there is this advantage, that the progress of the roots is seen all the while, and they are managed better as to the supply of water.

By repeated experiments in this way on dried bulbs, and on those taken fresh out of the ground, the former have been found to succeed the best. For those taken fresh out of the ground being full of moisture, will not so soon, upon changing their element, be nourished fully by a new one; and the fibres which they had struck in the ground, always rot when put into the water, and new ones must be formed in their places; so that it requires more time for them to come to flowering. The bulbs themselves will not rot in this manner; but they will never be so strong as those which were put into the water dry, which gradually fill themselves with moisture from it, and regularly plump up. The best method of managing the whole process is this: Place the bulbs at first only on the surface of the water; for thus they will strike out their fibres most strongly. When they have stood thus six weeks, pour in the water so high as to cover them entirely, and keep them thus till they have done flowering.

Sometimes the roots will become mouldy in several parts while they stand above the water, and the cleaning them of it is to no purpose; for it will eat and spread the farther, and frequently eat through two or three of their coats. In this case they must be immediately covered with water; when the mould will be

Flowering

ſtopped, and the roots become ſound, and flower as well as thoſe which never had any ſuch diſtemper. If the roots are ſuffered to remain in water all the year, they will not decay: but will flower again at their proper ſeaſon, and that as vigorouſly as thoſe which have been taken out and dried. The old fibres of thoſe roots never rot till they are ready to puſh forth new ones. It is found by experience, that the hyacinth, and many other plants, grow to a greater degree of perfection when thus in water than when in the ground. There is a peculiar ſpecies of hyacinth called *Keyſer's jewel*; this never, or very rarely, produces ſeed-veſſels in the common way of flowering in the ground; but it will often produce ſome pods when blown in water.

Mr Millar has intimated, in the Philoſophical Tranſactions, that bulbs ſet in glaſſes grow weaker, and ſhould be renewed every other year: but it is found, that, when managed in this manner, and kept under water, at the time of taking them up, they are as large, and ſome of them larger, than when planted; and if theſe be dried at a proper ſeaſon, they will flower, year after year, as well as freſh ones.

Ranunculus and anemone roots have been found to ſhoot up their ſtalks very well in this way; but the flowers are uſually blaſted, which ſeems to ariſe from want of free air. Pinks will flower very well in this manner; auriculas alſo may, with care, be brought to flower, but not ſtrongly. Roſes, jeſſamines, and honeyſuckles, may alſo be made to flower this way, and will thrive and ſend out ſuckers; the beſt pieces to plant, are ſuckers cut off about three inches under ground, without any fibres. The ſucculent plants may alſo be raiſed this way; for inſtance, the opuntia or Indian fig. If a fragment of a leaf of this plant be cut, and laid by to dry for a month till it is an abſolute ſkin, as ſoon as it is put in this manner into water, it begins to plump up, and ſoon ſends out fibrous roots, and produces new leaves as quickly as it would do in the ground.

This is the more ſingular in theſe ſorts of plants, becauſe in their natural ſtate in the ground, they cannot bear much water. This method of growing in water is not peculiar to the bulbous-rooted ones, but others may even be raiſed from ſeed by it. A bean or pea, ſet in this manner, will grow up to its proper ſtandard, and will flower and produce pods which will ripen their ſeed. The ſmaller ſeeds may be alſo raiſed in this manner, by the help of wool to ſupport them.

No vegetable tranſplanted out of the earth into water will thrive kindly; but any plant, whether raiſed from the root or ſeed in water, may be tranſplanted to the earth, and will ſucceed very well. It may be poſſible, therefore, from this method of raiſing plants in water, to come at a better way than is uſually practiſed of raiſing ſome roots in the earth which are ſubject to rot there; ſuch as anemonies, ranunculuſes, and hyacinths. A bulb dropped by chance upon the ground, will ſtrike out both ſtronger and more numerous fibres than thoſe which are planted in the uſual way in the ground. On this principle, it may be proper to take out the earth of the bed where the bulbs are to ſtand at the time of planting them, to ſuch a depth as they are to be placed under it when ſet for flowering. The bulbs are then to be ſet in their places, on the ſurface of this low ground; and to ſtand there till they have ſhot out their fibres and their head: then the earth is to be added over them by degrees, till they are covered as high above the head as they are in the uſual manner of planting them; thus they would be preſerved from the danger of rotting; and their fibres would be much ſtronger, and conſequently they would draw more nouriſhment, and flower better, than in the common way. The common method of planting theſe roots renders them liable to be deſtroyed by either extreme of a wet or a dry ſeaſon. In the firſt caſe, they immediately rot by the abundant moiſture they receive; and, in the ſecond, they become dry as a ſtick and mouldy, ſo that they are infallibly rotted by the firſt rain that falls afterwards. Flowering

The directions neceſſary to the ſucceſs of the bulbs planted in water are theſe. When the leaden falſe bottoms are fixed down tight within two or three inches of the bottom of the veſſel (which is only deſigned to hold the ſticks ſteady which are to ſupport the leaves and ſtalks), then lay on the lead upon which the bulbs are to reſt, placing the notched part oppoſite to that in the falſe bottom, as near as the ſticks, when placed, will ſuffer it; then place the bulbs one in each hole, and fill up with water to the upper lead. The bottom of the bulb will then touch the water; and as the water diminiſhes in quantity, keep it ſupplied with more up to the ſame height for a month or ſix weeks; in which time the bulbs will have ſhot ſtrong fibres. Then fill up the water about half an inch above the ſurface of the lead; and, by degrees, as the fibres ſtrengthen, and the plume ſhoots from the head, keep the water higher and higher, till at length the whole bulb is covered. The water is to be kept at this ſtandard till the ſeaſon for drying them returns.—At the time of planting the bulbs, they muſt be careſully cleaned from any foulneſſes at the bottom, by ſcraping them with the point of a knife till the ſound part of the bulb appears; clear them likewiſe from any looſe ſkins, and even take off their brown ſkin till they appear white; otherwiſe this brown ſkin will tinge the water, and the growth will not ſucceed ſo well.

The notches in the ſide of each lead are intended to give eaſy paſſage to the water, that, if there ſhould be any foulneſs or ſediment in it, on ſhaking it a little it may all run through, and freſh water be put in its place. But this ſhifting the water need not be done more than once or twice in a winter, as there may be occaſion from the foulneſs; and when this is done, the ſides of the veſſel ſhould be cleaned with a painter's bruſh, and rinſed out again, and the bulbs themſelves waſhed, by pouring water on them at a little diſtance.

At any time when the outer ſkins of the bulbs dry, they are to be peeled off, that they may not occaſion foulneſs in the water; and if any duſt or foul matter be at any time obſerved ſwimming on the ſurface, the method is to fill up the pot or veſſel to the rim, and let it run over: this will carry off that light foulneſs, and the water may afterwards be poured away to the proper ſtandard.

Bulbs of equal bigneſs ſhould be planted together in the

Fludd || Fluid.

the ſame pot, that they may all have the ſame benefit of the water. Narciſſuſes and hyacinths do well together; as alſo tulips and jonquils, and crocuſes and ſnowdrops.

FLUDD, Robert, a philoſopher and phyſician of ſome celebrity in his time, was the ſon of Sir Thomas Fludd, treaſurer of war to Queen Elizabeth; and was born at Milgate in Kent, in the year 1574. He received his education at St John's college, Oxford, and afterwards ſpent ſix years in travelling through Europe. He acquired a ſtrong attachment to the Roſycruſian philoſophy, which chiefly conſiſted of myſticiſm and jargon, and ſuch as were admitted among them had certain ſecrets analogous to thoſe of free maſonry. On his return home, he took the degree of M. D. ſettled in the city of London, and was choſen a fellow of the college of phyſicians. His piety was of an enthuſiaſtic nature, and the ſeeming depth of his knowledge procured him much admiration, and gave him a temporary fame. It is ſaid that he employed a kind of unintelligible cant when ſpeaking to his patients, which ſometimes contributed to their recovery, as it operated on their faith. He is chiefly known as a ſectary in philoſophy, and not as a phyſician. He blended the incomprehenſible reveries of the Cabaliſts and Paracelſians, forming a new phyſical ſyſtem replete with myſtery and abſurdity. He believed in two univerſal principles, the northern or condenſing, and the ſouthern or rarefying power. Innumerable geniuſes he conceived to preſide over theſe, and committed the charge of diſeaſes to légions of ſpirits collected from the four winds of heaven. In his eſtimation, a harmony ſubſiſted between the macrocoſm and the microcoſm, or the world of nature and of man. All his fancies and whims it is impoſſible to enumerate, yet they attracted the notice of the philoſophers of that age, being ſupported by myſterious gravity and the ſhadow of erudition. Even Kepler himſelf thought his extravagant jargon worthy of refutation, and Gaſſendi for this purpoſe wrote his *Examen Philoſophiæ Fluddianæ*. One of Fludd's performances, entitled *Nexus utriuſque Coſmi*, is illuſtrated by ſome prints of a very ſingular and extraordinary nature.

FLUENT, or Flowing Quantity, in the doctrine of fluxions, is the variable quantity which is conſidered as increaſing and decreaſing: or the fluent of a given fluxion, is that quantity whoſe fluxion being taken, according to the rules of that doctrine, ſhall be the ſame with the given fluxion. See Fluxions.

FLUID, an appellation given to all bodies whoſe particles eaſily yield to the leaſt partial preſſure, or force impreſſed. For the

Laws and Properties of Fluids, ſee Hydrostatics.

There are various kinds of animalcules to be diſcerned in different fluids by the microſcope. Of many remarkable kinds of theſe, a deſcription is given under the article Animalcule. All of theſe little creatures are eaſily deſtroyed by ſeparating them from their natural element. Naturaliſts have even fallen upon ſhorter methods. A needle point, dipped in ſpirit of vitriol, and then immerſed into a drop of pepper water, readily kills all the animalcules: which, though before friſking about with great livelineſs and activity, no ſooner come within the influence of the acid particles, than they ſpread themſelves, and tumble down to all appearance dead. The like may be done by a ſolution of ſalt; only with this difference, that, by the latter application, they ſeem to grow vertiginous, turning round and round till they fall down. Tincture of ſalt of tartar, uſed in the ſame manner, kills them ſtill more readily; yet not ſo, but there will be apparent marks of their firſt being ſick and convulſed. Inks deſtroy them as faſt as ſpirit of vitriol, and human blood produces the ſame effect. Urine, ſack, and ſugar, all deſtroy them, though not ſo faſt; beſides, that there is ſome diverſity in their figures and appearances, as they receive their deaths from this poiſon or that. The point of a pin dipped in ſpittle, preſently killed all the kinds of animalcules in puddle water, as Mr Harris ſuppoſes it will other animalcules of this kind. Fluid.

All who are acquainted with microſcopic obſervations, know very well, that in water, in which the beſt glaſſes can diſcover no particle of animated matter, after a few grains of pepper, or a fragment of a plant of almoſt any kind, has been ſome time in it, animals full of life and motion are produced; and thoſe in ſuch numbers, as to equal the fluid itſelf in quantity.—When we ſee a numerous brood of young fiſhes in a pond, we make no doubt of their having owed their origin to the ſpawn, that is, to the eggs of the parents of the ſame ſpecies. What are we then to think of theſe? If we will conſider the progreſs of nature in the inſect tribes in general, and eſpecially in ſuch of them as are moſt analogous to theſe, we ſhall find it leſs difficult to give an account of their origin than might have been imagined.

A ſmall quantity of water taken from any ditch in the ſummer months, is found to be full of little worms, ſeeming in nothing ſo much as in ſize to differ from the microſcopic animalcules. Nay, water, without theſe, expoſed in open veſſels to the heat of the weather, will be always found to abound with multitudes of them, viſible to the naked eye, and full of life and motion. Theſe we know, by their future changes, are the fly worms of the different ſpecies of gnats, and multitudes of other fly ſpecies; and we can eaſily determine, that they have owed their origin only to the eggs of the parent fly there depoſited. Nay, a cloſer obſervation will at any time give ocular proof of this; as the flies may be ſeen laying their eggs there, and the eggs may be followed through all their changes to the fly again. Why then are we to doubt but that the air abounds with other flies and animalcules as minute as the worms in thoſe fluids; and that theſe laſt are only the fly worms of the former, which after a proper time ſpent in that ſtate, will ſuffer changes like thoſe of the larger kinds, and become flies like thoſe to whoſe eggs they owed their origin? *Vid. Reaumur, Hiſt. Inſect.* vol. iv. p. 431.

The differently medicated liquors made by infuſions of different plants, afford a proper matter for the worms of different ſpecies of theſe ſmall flies: and there is no reaſon to doubt, but that among theſe ſome are viviparous, others oviparous; and to this may be, in a great meaſure owing the different time taken up for the production of theſe inſects in different fluids. Thoſe which are a proper matter for the worms of the viviparous fly, may be ſooneſt found full of them; as, probably the liquor is no ſooner in a ſtate to afford them

Fluid. them proper nourifhment, than their parents place them there: whereas thofe produced from the eggs of the little oviparous flies, muft, after the liquor is in a proper ftate, and they are depofited in it in the form of eggs, have a proper time to be hatched, before they can appear alive.

It is eafy to prove, that the animals we find in thefe vegetable infufions were brought thither from elfewhere. It is not lefs eafy to prove, that they could not be in the matter infufed any more than in the water in which it is infufed.

Notwithftanding the fabulous accounts of falamanders, it is now well known, that no animal, large or fmall, can bear the force of fire for any conficerable time; and, by parity of reafon, we are not to believe, that any infect, or embryo infect, in any ftate, can bear the heat of boiling water for many minutes. To proceed to inquiries on this foundation: If feveral tubes filled with water, with a fmall quantity of vegetable matter, fuch as pepper, oak bark, truffles, &c. in which, after a time, infects will be difcovered by the microfcope; and other like tubes be filled with fimple water boiled, with water and pepper boiled together, and with water with the two other ingredients all feparately boiled in it; when all thefe liquors come to a proper time for the obfervation of the microfcope, all, as well thofe which have been boiled as thofe which have not, will be found equally to abound with infects, and thofe of the fame kind, in infufions of the fame kind, whether boiled or not boiled. Thofe in the infufions which had fuftained a heat capable of deftroying animal life, muft therefore not have fubfifted either in the water or in the matters put into it, but muft have been brought thither after the boiling; and it feems by no way fo probably, as by means of fome little winged inhabitants of the air depofiting their eggs or worms in thefe fluids.

On this it is natural to afk, how it comes to pafs, that while we fee myriads of the progeny of thefe winged infects in water, we never fee themfelves? The anfwer is equally eafy, viz. becaufe we can always place a drop of this water immediately before the focus of the microfcope, and keep it there while we are at leifure to examine its contents; but that is not the cafe with regard to the air inhabited by the parent flies of thefe worms, which is an immenfe extent in proportion to the water proper for nourifhing thefe worms; and confequently, while the latter are clufered together in heaps, the former may be difperfed and fcattered. Nor do we want inftances of this, even in infects of a larger kind. In many of our gardens, we frequently find veffels of water filled with worms of the gnat kind, as plentifully, in proportion to their fize, as thofe of other fluids are with animalcules. Every cubic inch of water in thefe veffels contains many hundreds of animals: yet we fee many cubic inches of air in the garden not affording one of the parent flies.

But neither are we pofitively to declare that the parent flies of thefe animalcules are in all ftates wholly invifible to us; if not fingly to be feen, there are fome ftrong reafons to imagine that they may in great clufters. Every one has feen in a clear day, when looking ftedfaftly at the fky, that the air is in many places difturbed by motions and convolutions in certain fpots. Thefe cannot be the effects of imagination, or of faults in our eyes, becaufe they appear the fame to all; and if we conlider what would be the cafe to an eye formed in fuch a manner as to fee nothing fmaller than an ox, on viewing the air on a marfh fully peopled with gnats, we muft be fenfible that the clouds of thefe infects, though to us diftinctly enough vifible, would appear to fuch an eye merely as the moving parcels of air in the former inftance do to us: and furely it is thence no rafh conclufion to infer, that the cafe may be the fame, and that myriads of flying infects, too fmall to be fingly the objects of our view, yet are to us what the clouds of gnats would be in the former cafe. Fluid, Fluidity

Nervous FLUID. See ANATOMY *Index*.

Elaftic FLUIDS. See CHEMISTRY *Index*.

FLUIDITY, is by Sir Ifaac Newton defined to be, that property of bodies by which they yield to any force impreffed, and which have their parts very eafily moved among one another.

To this definition fome have added, that the parts of a fluid are in a continual motion. This opinion is fupported by the folution of falts, and the formation of tinctures. If a fmall bit of faffron is thrown into a phial full of water, a yellow tincture will foon be communicated to the water to a conficerable height, though the phial is allowed to remain at reft; which indicates a motion in thofe parts of the fluid which touch the faffron, by which its colouring matter is carried up.

With regard to water, this can fcarce be denied; the conftant exhalations from its furface fhow, that there muft be a perpetual motion in its parts from the afcent of the fteam through it. In mercury, where infenfible evaporation does not take place, it might be doubted; and accordingly the Newtonian philofophers in general have been of opinion, that there are fome fubftances effentially fluid, from the fpherical figure of their conftituent particles. The congelation of mercury, however, by an extreme degree of cold, demonftrates that fluidity is not effentially inherent in mercury more than in other bodies.

That fluids have vacuities in their fubftance is evident, becaufe they may be made to diffolve certain bodies without fenfibly increafing their bulk. For example, water will diffolve a certain quantity of falt; after which it will receive a little fugar, and after that a little alum, without increafing its firft dimenfions. Here we can fcarce fuppofe any thing elfe than that the faline particles were interpofed between thofe of the fluid; and as, by the mixture of falt and water, a conficerable degree of cold is produced, we may thence eafily fee why the fluid receives thefe fubftances without any increafe of bulk. All fubftances are expanded by heat, and reduced into lefs dimenfions by cold; therefore, if any fubftance is added to a fluid, which tends to make it cold, the expanfion by the bulk of the fubftance added will not be fo much perceived as if this effect had not happened; and if the quantity added be fmall, the fluid will contract as much, perhaps more, from the cold produced by the mixture, than it will be expanded from the bulk of the falt. This alfo may let us know with what thefe interftices between the particles of the fluid were filled up; namely, the element of fire or heat. The faline particles, up-

Fluidity, Fluke. on their folution in the fluid, have occupied thefe fpaces; and now the liquor being deprived of a quantity of this element equal in bulk to the falt added, feels fenfibly colder.

As, therefore, there is fcarce any body to be found, but what may become folid by a fufficient degree of cold, and none but what a certain degree of heat will render fluid; the opinion naturally arifes, that fire is the caufe of fluidity in all bodies, and that this element is the only eſſentially fluid ſubſtance in nature. Hence we may conclude, that thoſe ſubſtances which we call *fluids* are not eſſentially ſo, but only aſſume that appearance in conſequence of an intimate union with the element of fire; juſt as gums aſſume a fluid appearance on being diſſolved in ſpirit of wine, or ſalts in water.

Upon theſe principles Dr Black mentions fluidity as an effect of heat. The different degrees of heat which are required to bring different bodies into a ſtate of fluidity, he ſuppoſes to depend on ſome particulars in the mixture and compoſition of the bodies themſelves: which becomes extremely probable, from conſidering that we change the natural ſtate of bodies in this reſpect, by certain mixtures; thus, if two metals are compounded, the mixture is uſually more fuſible than either of them ſeparately. See CHEMISTRY *Index*.

It is certain, however, that water becomes warmer by being converted into ice; which may ſeem contradictory to this opinion. To this, however, the doctor replies, that fluidity does not conſiſt in the degree of ſenſible heat contained in bodies, which will affect the hand or a thermometer; but in a certain quantity which remains in a latent ſtate. This opinion he ſupports from the great length of time required to melt ice; and to aſcertain the degree of heat requiſite to keep water in a fluid ſtate, he put five ounces of water into a Florence flaſk, and converted it into ice by means of a freezing mixture put round the flaſk. Into another flaſk of the ſame kind he put an equal quantity of water cooled down nearly to the freezing point, by mixing it with ſnow, and then pouring it off. In this he placed a very delicate thermometer; and found that it acquired heat from the air of the room in which it was placed: ſeven degrees of heat were gained the firſt half hour. The ice being expoſed to the ſame degree of heat, namely, the air of a large room without fire, it cannot be doubted that it received heat from the air as faſt as the water which was not frozen; but, to prevent all poſſibility of deception, he put his hand under the flaſk containing the ice, and found a ſtream of cold air very ſenſibly deſcending from it, even at a conſiderable diſtance from the flaſk; which undeniably proved, that the ice was all that time abſorbing heat from the air. Nevertheleſs, it was not till 11 hours that the ice was half melted, though in that time it had abſorbed ſo much heat as ought to have raiſed the thermometer to 142°; and even after it was melted, the temperature of the water was found ſcarce above the freezing point: ſo that, as the heat which entered could not be found in the melted ice, he concluded that it remained concealed in the water, as an eſſential ingredient of its compoſition.

FLUKE, or FLOUNDER. See PLEURONECTES, ICHTHYOLOGY *Index*.

FLUKE Worm. See FASCIOLA, HELMINTHOLOGY *Index*. Fluke || Flute.

FLUKE of an Anchor, that part of it which faſtens in the ground. See ANCHOR.

FLUMMERY, a wholeſome ſort of jelly made of oatmeal.

The manner of preparing it is as follows. Put three large handfuls of finely ground oatmeal to ſteep, for 24 hours, in two quarts of fair water: then pour off the clear water, and put two quarts of freſh water to it; ſtrain it through a fine hair ſieve, putting in two ſpoonfuls of orange flower water, and a ſpoonful of ſugar: boil it till it is as thick as a haſty pudding, ſtirring it continually while it is boiling, that it may be very ſmooth.

FLUOR, in *Phyſics*, a fluid; or, more properly, the ſtate of a body that was before hard or ſolid, but is now reduced by fuſion or fire into a ſtate of fluidity.

FLUOR Acid. See *FLUORIC Acid*, CHEMISTRY *Index*.

FLUOR Albus, a flux incident to women, commonly known by the name of *whites*. See MEDICINE *Index*.

FLUOR Spar, or *Blue John*, called alſo fluxing ſpars, vitreſcent or glaſs ſpars, are minerals compoſed of calcareous earth united with fluoric acid. See MINERALOGY *Index*.

FLUSHING, a handſome, ſtrong, and conſiderable town of the United Provinces, in Zealand, and in the iſland of Walcheren, with a very good harbour, and a great foreign trade. It was put into the hands of Queen Elizabeth for a pledge of their fidelity, and as a ſecurity for the money ſhe advanced. It is one of the three places which Charles V. adviſed Philip II. to preſerve with care. E. Long. 3. 32. N. Lat. 51. 26.

FLUTE, an inſtrument of muſic, the ſimpleſt of all thoſe of the wind kind. It is played on by blowing it with the mouth; and the tones or notes are changed by ſtopping and opening the holes diſpoſed for that purpoſe along its ſide.

This is a very ancient inſtrument. It was at firſt called the flute *à bec*, from *bec* an old Gauliſh word ſignifying the beak of a bird or fowl, but more eſpecially of a cock; the term *flute à bec* muſt therefore ſignify the *beaked flute*; which appears very proper, on comparing it with the traverſe or German flute. The word *flute* is derived from *fiuta*, the Latin for a lamprey or ſmall eel taken in the Sicilian ſeas, having ſeven holes immediately below the gills on each ſide, the preciſe number of thoſe in the front of the flute.

By Merſennus this inſtrument is called the *fiſtula dulcis, ſeu Anglica*; the loweſt note, according to him, for the treble flute, is *C ſa ut*, and the compaſs of the inſtrument 15 notes. There is, however, a flute known by the name of the *concert flute*, the loweſt note of which is F. Indeed, ever ſince the introduction of the flute into concerts, the loweſt note of the inſtrument, of what ſize ſoever it is, has been called F; when in truth its pitch is determinable only by its correſpondence in reſpect of acuteneſs or gravity with one or other of the chords in the *ſcala maxima* or great ſyſtem.

Beſides the true concert flute, others of a leſs ſize were ſoon introduced into concerts of violins; in which caſe the method was to write the flute part in a key correſponden-

Flute. correſpondent to its pitch. This practice was introduced in 1710 by one Woodcock, a celebrated performer on this inſtrument, and William Babell organiſt of the church of All-hallows, Bread Street, London. They failed, however, in procuring for the flute a reception into concerts of various inſtruments; for which reaſon, one Thomas Staneſby, a very curious maker of flutes and other inſtruments of the like kind, about the year 1732, adverting to the ſcale of Merſennus, in which the loweſt note was C, invented what he called the *new ſyſtem*; in which, by making the flute of ſuch a ſize as to be a fifth above concert pitch, the loweſt note became *C ſol fa ut*. By this contrivance the neceſſity of tranſpoſing the flute part was taken away; for a flute of this ſize, adjuſted to the violin. To further this invention of Staneſby's, one Lewis Merci, an excellent performer on the flute, publiſhed, about the year 1735, ſix ſolos for this inſtrument, three of which are ſaid to be accommodated to Mr Staneſby's new ſyſtem; but the German flute was now become a favourite inſtrument, and Staneſby's ingenuity failed of its effect.—One great objection indeed lies againſt this inſtrument, which, however, equally affects all perforated pipes; namely, that they are never perfectly in tune, or cannot be made to play all their notes with equal exactneſs. The utmoſt that the makers of them can do is to tune them to ſome one key; as the hautboy to C, the German flute to D, and the Engliſh flute to F; and to effect this truly, is a matter of no ſmall difficulty. The Engliſh flutes made by the younger Staneſby came the neareſt of any to perfection; but thoſe of Breſſan, though excellent in their tone, are all too flat in the upper octave. For theſe reaſons ſome are induced to think, that the utmoſt degree of proficiency on any of thoſe inſtruments is not worth the labour of attaining it.

German FLUTE, is an inſtrument entirely different from the common flute. It is not, like that, put into the mouth to be played; but the end is ſtopt with a tompion or plug, and the lower lip is applied to a hole about two inches and a half or three inches diſtant from the end. This inſtrument is uſually about a foot and a half long; rather bigger at the upper end than the lower; and perforated with holes, beſides that for the mouth, the loweſt of which is ſtopped and opened by the little finger's preſſing on a braſs or ſometimes a ſilver key, like thoſe in hautboys, baſſoons, &c. Its ſound is exceeding ſweet and agreeable; and ſerves as a treble in a concert.

FLUTE, or FLUYT, is a kind of long veſſel, with flat ribs or floor timbers, round behind, and ſwelled in the middle; ſerving chiefly for the carrying of proviſions in fleets or ſquadrons of ſhips; though it is often uſed in merchandiſe. The word *flute* taken for a ſort of boat or veſſel, is derived, according to Borel, from the ancient *flotte*, a little boat. In the verbal proceſs of the miracles of St Catharine of Sweden, in the 12th century, we read *Unus equum ſuum una cum mercibus magni ponderis introduxit ſuper inſtrumentum de lignis fabricatum, vulgariter dictum fluta.* Upon which the Bollandiſts obſerve, that in ſome copies it is read *flotta*, an inſtrument called by the Latins *ratis*; and that the word *flutta* or *flotta* aroſe from *flotten* or *vlotten*, "to float."

FLUTES, or FLUTINGS, in *Architecture*, are perpendicular channels or cavities cut along the ſhaft of a column or pilaſter. They are ſuppoſed to have been firſt introduced in imitation of the plaits of women's robes; and are therefore called by the Latins *ſtriges* and *rugæ*. The French call them *cannelures*, as being excavations; and we, *flutes* or *flutings*, as bearing ſome reſemblance to the muſical inſtrument ſo called. They are chiefly affected in the Ionic order, in which they had their firſt riſe; though they are alſo uſed in all the richer orders, as the Corinthian and Compoſite; but rarely in the Doric, and ſcarce ever in the Tuſcan. Flux.

FLUX, in *Medicine*, an extraordinary iſſue or evacuation of ſome humour. Fluxes are various, and variouſly denominated, according to their ſeats or the humours thus voided; as a flux of the belly, uterine flux, hepatic flux, ſalival flux, &c. The flux of the belly is of four kinds, which have each their reſpective denominations, viz. the *lientery*, or *fluxus lientericus*; the *cæliac*, or *fluxus chyloſus*; the *diarrhœa*; and the *dyſentery*, or *bloody flux*. See MEDICINE *Index*.

FLUX, in *Hydrography*, a regular periodical motion of the ſea, happening twice in 24 hours; wherein the water is raiſed and driven violently againſt the ſhores. The flux or flow is one of the motions of the tide; the other, whereby the water ſinks and retires, is called the reflux or ebb. There is alſo a kind of reſt or ceſſation of about half an hour between the flux and reflux; during which time the water is at its greateſt height, called *high-water*. The flux is made by the motion of the water of the ſea from the equator towards the poles; which, in its progreſs, ſtriking againſt the coaſts in its way, and meeting with oppoſition from them, ſwells, and where it can find paſſage, as in flats, rivers, &c. riſes up and runs into the land. This motion follows, in ſome meaſure, the courſe of the moon; as it loſes or comes later every day by about three quarters of an hour, or more preciſely by 48 minutes; and by ſo much is the motion of the moon ſlower than that of the ſun. It is always higheſt and greateſt in full moons, particularly thoſe of the equinoxes. In ſome parts, as at Mount St Michael, it riſes 80 or 90 feet, though in the open ſea it never riſes above a foot or two; and in ſome places, as about the Morea, there is no flux at all. It runs up ſome rivers above 120 miles. Up the river Thames it only goes 80, viz. near to Kingſton in Surry. Above London bridge the water flows four hours and ebbs eight; and below the bridge, flows five hours and ebbs ſeven.

FLUX, in *Metallurgy*, is ſometimes uſed ſynonymouſly with *fuſion*. For inſtance, an ore, or other matter, is ſaid to be in a liquid flux, when it is completely fuſed.

But the word *flux* is generally uſed to ſignify certain ſaline matters, which facilitate the fuſion of ores, and other matters which are difficultly fuſible in eſſays and reductions of ores; ſuch are alkalies, nitre, borax, tartar, and common ſalt. But the word *flux* is more particularly applied to mixtures of different proportions of only nitre and tartar; and theſe fluxes are called by particular names, according to the proportions of theſe ingredients, as in the following articles.

White FLUX, is made with equal parts of nitre and of tartar detonated together, by which they are alkalized.

Flux. lized. The reſiduum of this detonation is an alkali compoſed of the alkalies of the nitre and of the tartar, both which are abſolutely of the ſame nature. As the proportion of nitre in this mixture is more than is ſufficient to conſume entirely all the inflammable matter of the tartar, the alkali remaining after the detonation is perfectly white, and is therefore called *white flux*; and as this alkali is made very quickly, it is alſo called *extemporaneous alkali*. When a ſmall quantity only of white flux is made, as a few ounces for inſtance, ſome nitre always remains undecompoſed, and a little of the inflammable principle of the tartar, which gives a red or even a black colour to ſome part of the flux; but this does not happen when a large quantity of white flux is made; becauſe then the heat is much greater. This ſmall quantity of undecompoſed nitre and tartar which remains in white flux is not hurtful in moſt of the metallic fuſions in which this flux is employed: but if the flux be required perfectly pure, it might eaſily be diſengaged from thoſe extraneous matters by a long and ſtrong calcination, without fuſion.

Crude Flux. By crude flux is meant the mixture of nitre and tartar in any proportions, without detonation. Thus the mixture of equal parts of the two ſalts uſed in the preparation of the white flux, or the mixture of one part of nitre and two parts of tartar for the preparation of the black flux, are each of them a crude flux before detonation. It has alſo been called *white flux*, from its colour; but this might occaſion it to be confounded with the white flux above deſcribed. The name, therefore, of crude flux is more convenient. Flux

Crude flux is detonated and alkalized during the reductions and fuſions in which it is employed; and is then changed into white or black flux, according to the proportions of which it is compoſed. This detonation produces good effects in theſe fuſions and reductions, if the ſwelling and extravaſation of the detonating matters be guarded againſt. Accordingly, crude flux may be employed ſucceſsfully in many operations; as, for inſtance, in the ordinary operation for procuring the regulus of antimony.

Black Flux. Black flux is produced from the mixture of two parts of tartar and one part of nitre detonated together. As the quantity of nitre which enters into the compoſition of this flux is not ſufficient to conſume all the inflammable matters of the tartar, the alkali which remains after the detonation contains much black matter, of the nature of coal, and is therefore called *black flux*.

FLUXIONS.

Introduction.

INTRODUCTION.

THE branch of mathematical analyſis which is called in this country the *Method of Fluxions*, but on the continent the *Differential* and *Integral Calculi*, was invented near the end of the 17th century; and *Sir Iſaac Newton*, and *Mr Leibnitz*, two of the greateſt philoſophers of that age, have both claimed the diſcovery.

It will appear very poſſible that two ſuch men ſhould both fall upon this method of calculation nearly about the ſame time, if it be conſidered, that from the beginning of the 17th century its principles were gradually coming into view, in conſequence of the united labours and diſcoveries of a number of mathematicians, ſuch as *Napier*, *Cavallerius*, *Roberval*, *Fermat*, *Barrow*, *Wallis*, and others. And conſidering the number of men of the firſt abilities engaged at that time in the ſtudy of mathematics, we may reaſonably ſuppoſe, that the fluxional, or differential calculus would very ſoon have been found according to the ordinary progreſs of human knowledge, even although a *Newton*, or a *Leibnitz*, had not by the force of ſuperior genus anticipated perhaps by a few years that event. The firſt intimation that was given of the diſcovery of the calculus was in the year 1669, when, through the intervention of *Dr Barrow*, a correſpondence was begun between *Sir Iſaac Newton* (then *Mr Newton*), and *Mr Collins*, one of the ſecretaries to the Royal Society. *Dr Barrow* communicated to the latter a paper by *Newton*, which had for its title, *De analyſi per æquationes numero terminorum infinitas*. In this paper, beſides ſhewing how to reſolve equations by approximation, *Newton* teaches how to ſquare curves, not only when the expreſſion for the ordinate in terms of the abſciſſa is a rational quantity, but alſo when it involves radical quantities, by firſt reſolving theſe into an infinite ſeries of rational terms by means of the binomial theorem, a thing which had never before been done. *Newton* in this paper gives ſome rather obſcure indications of the nature of his calculus, which however ſerve to ſhew, beyond all doubt, that he was then in poſſeſſion of it; and indeed there is good reaſon to believe that he knew it as early as the year 1665, or even ſooner. Introduction.

Theſe analytical diſcoveries of *Newton* were immediately circulated among mathematicians both in this country and abroad, by *Dr Barrow*, and by *Collins* and *Oldenburg*, the two ſecretaries to the Royal Society.

About the end of the year 1672, *Newton* communicated to *Collins*, by letter, a method of drawing tangents to curve lines, illuſtrated by an example, from which it again plainly appears, that he now poſſeſſed his method of fluxions.

In the courſe of the following year, *Leibnitz* came to London, and communicated to ſeveral members of the Royal Society, ſome reſearches relating to the theory of differences. It was however ſhewn to him, that this ſubject had been previouſly treated by *Mouton*, an aſtronomer of Lyons; upon this *Leibnitz* directed his attention to the doctrine of ſeries, which was now conſiderably advanced, in conſequence of the diſcoveries of the Engliſh mathematicians.

The firſt direct communication that paſſed between *Newton* and *Leibnitz*, was by a letter, which the former addreſſed to *Oldenburg*, about the middle of the year 1676. In the beginning of this letter, which was intended to be ſhewn to *Leibnitz*, *Newton* ſpeaks of him with much reſpect. The letter itſelf chiefly refers to

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the theory of infinite ſeries. In a ſecond letter, written alſo with a view to its being communicated to *Leibnitz*, *Newton*, after beſtowing deſerved commendation on him, proceeds to explain the ſteps by which he was led to the diſcovery of the binomial theorem. He afterwards, among other things, delivers ſeveral theorems which have the method of fluxions for their baſis; but he does not give their demonſtrations, and only obſerves, that they depend on the ſolution of a general problem, the enunciation of which he conceals under an anagram of tranſpoſed letters, but the meaning of it is this: *An equation being given containing any number of flowing quantities, to find their fluxions; and the contrary.* This letter affords another proof that *Newton* was now in full poſſeſſion of his calculus.

In the end of June 1677, *Leibnitz* ſent to *Oldenburg*, for the purpoſe of being communicated to *Newton*, a letter containing the firſt eſſays of his *Differential Calculus*. The death of *Oldenburg*, which happened ſoon after, put an end to the correſpondence, and in the year 1684, *Leibnitz* publiſhed his method, in the *Leipſic Acts* for the month of October 1684. The title of the memoir which contained it was, *Nova methodus pro* maximis et minimis, *itemque tangentibus, quæ nec fractas, nec irrationales quantitates moratur, et ſingulare pro illis calculi genus.* Thus, in whatever way *Leibnitz* came by his calculus, whether he diſcovered it ſolely by the force of his own genius, or founded it on the method of fluxions, previouſly invented by *Newton*, both of which hypotheſes are poſſible, his method was certainly publiſhed before *Newton's*, which, except what tranſpired in conſequence of the circulation of his letters and manuſcripts, became only known to the world in general for the firſt time, by the publication of the *Principia* in the end of the year 1686.

It ſeems at firſt to have been allowed, that *Leibnitz* had invented his calculus, without having any previous knowledge of what had been done by *Newton;* for in the firſt edition of the *Principia*, *Newton* ſays, "In the courſe of a correſpondence which ten years ago I carried on with the very learned geometrician *Mr Leibnitz*, having intimated to him that I poſſeſſed a method of determining *maxima* and *minima*, of drawing tangents, and reſolving ſuch problems, not only when the equations were rational, but alſo when they were irrational; and having concealed this method, by tranſpoſing the letters of the following ſentence—*An equation being given, containing any number of flowing quantities, to find their fluxions; and the contrary;* this celebrated man anſwered that he had found a ſimilar method, which he communicated to me, and which differs from mine, only in the enunciation, and in the notation." To this, in the edition of 1714 is added, "and in the manner of conceiving the quantities to be generated." *

* *Principia*, lib. ii. lem. 2. ſchol.

There is reaſon to ſuppoſe that *Leibnitz* might have continued to enjoy undiſturbed the honour of being conſidered as one of the inventors of the fluxional, or differential calculus, if he had not manifeſted a diſpoſition to attribute the invention too excluſively to himſelf. This called forth ſome remarks reſpecting the priority of *Newton's* claim to the diſcovery. In particular *M. Facio* aſſerted, in a treatiſe *on the Line of ſwifteſt deſcent*, publiſhed in 1699, "that he was obliged to own *Newton* as the *firſt inventor* of the differential calculus, and the firſt by many years; and that he left the world to judge whether *Leibnitz*, the *ſecond inventor* had taken any thing from him." Introduction.

On the other hand, when *Newton's* treatiſe on the quadrature of curves, and on the enumeration of lines of the third order was publiſhed, which was in 1704, the Leipſic journaliſts inſinuated, in a very illiberal account which they gave of the work, that *Leibnitz* was the firſt inventor, and that *Newton* had taken his method from *Leibnitz's*, ſubſtituting fluxions for differences.

In conſequence of this attack on *Newton*, *Dr John Keill* aſſerted, in the Philoſophical Tranſactions for 1708, that *Newton* was beyond a doubt the firſt inventor of the arithmetic of fluxions, and that the ſame arithmetic, having its name and notation changed, was afterwards publiſhed by *Mr Leibnitz* in the Leipſic Acts. In anſwer to this, *Leibnitz* replied, in a letter to *Hans Sloane*, ſecretary to the Royal Society, that no one knew better than *Newton* himſelf, that the charge againſt him implied in *Keill's* aſſertion was falſe; and he required *Keill* to retract what he had ſaid. To this requeſt however *Keill* would by no means accede; but on the contrary, he wrote a long letter to the ſecretary of the Royal Society, in which he endeavoured to prove, not only that *Newton* had preceded *Leibnitz* in the invention, but that he had given to the latter ſuch indications of the nature of his calculus, as made it eaſy for him to fall upon the ſame. This letter was ſent to *Leibnitz*, who replied, that *Keill*, although learned, was too young a man to be fit to judge of what had paſſed between him and *Newton*, and he requeſted the Royal Society to put a ſtop to *Keill's* clamours.

The Royal Society being thus appealed to as a judge, appointed a committee to examine all the old letters, papers, and documents, which had paſſed among the ſeveral mathematicians, relating to the queſtion. The judgment of the committee was to the following effect. "That *Mr Leibnitz* was in London in 1673, and went thence to Paris, where he kept a correſpondence with *Mr Collins*, by means of *Mr Oldenburg*, till about September 1676, and then returned by London and Amſterdam, to Hanover; and that *Mr Collins* was very free in communicating to able mathematicians what he had received from *Newton*. That it did not appear, that *Mr Leibnitz* knew any thing of the differential calculus before his letter of the 21ſt of June 1677, which was a year after a copy of *Newton's* letter of the 10th of December 1672 had been ſent to Paris, to be communicated to him, and above four years after *Mr Collins* began to communicate that letter to his correſpondents; in which letter, the method of fluxions was ſufficiently deſcribed to any intelligent perſon. That *Newton* was in poſſeſſion of his calculus before the year 1669, and that thoſe who had reputed *Leibnitz* the firſt inventor, knew little or nothing of his correſpondence with *Mr Collins*, and *Mr Oldenburg*, long before, nor of *Newton's* having that method above 15 years before *Mr Leibnitz* began to publiſh it in the Leipſic Acts. That for theſe reaſons, they reckoned *Newton* the firſt inventor, and were of opinion, that *Mr Keill* in aſſerting the ſame had been in no ways injurious to *Mr Leibnitz*."

It is deſerving of remark, that the committee delivered no opinion upon the advantage which *Leibnitz* was accuſed of having taken of the hints furniſhed to him,

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in the course of his correspondence with *Newton*; they left the decision of this point to the world in general; and to enable every one to judge for himself, the Royal Society ordered the opinion of the committee to be printed, together with all the documents upon which it was founded. These appeared in 1712 under the title of, *Commercium Epistolicum de Analysi promota*. This work was carefully circulated over Europe, to vindicate the title of the English nation to the discovery.

The *Commercium Epistolicum* having appeared, *Leibnitz* expressed great dissatisfaction, and threatened to reply in such a manner as to confound his adversaries. There seems no reason however to suppose, that any thing he could have said, would have affected *Newton's* claim to the honour of being the first inventor; for on this point there cannot be any doubt. With respect, however, to the other question, whether *Leibnitz* took his calculus from *Newton*, or found it himself, it is impossible to decide with such certainty. *Mr Montucla*, in his History of Mathematics, * says, "There are only three places of the *Commercium Epistolicum*, which treat of the principles of fluxions in so clear a way, as to prove that *Newton* had found it before *Leibnitz*, but too obscurely, it seems, to take from the latter the merit of the discovery. One of these is in a letter from *Newton* to *Oldenburg*, who had signified to him, that *Slusius* and *Gregory* had each found a very simple method of drawing tangents. *Newton* replied, that he conjectured what the nature of that method was; and he gave an example of it, which shews it to be in effect the same thing as those geometricians had found. He adds, that it is only a particular case, or rather a corollary to a method much more general, which, without a laborious calculation, applies to the finding of tangents to all sorts of curves, geometrical or mechanical, and that without being obliged to free the equation from radicals. He repeats the same thing without explaining himself farther, in another letter, and he conceals the principle of the method under transposed letters. The only place where *Newton* has allowed any thing of his method to transpire, is in his *Analysis per æquationes numero terminas infinitas*. He here discloses, in a very concise and obscure manner, his principle of fluxions, but there is no certainty of *Leibnitz's* having seen this essay. His opponents have never asserted that it was communicated to him by letter, and they have gone no farther than to suspect, that he had obtained a knowledge of it in the interview which he had with *Collins*, upon his second journey to London. Indeed, this suspicion is not entirely destitute of probability, for *Leibnitz* admitted, that in this interview, he saw a part of the *Epistolary Correspondence* of *Collins*. However I think it would be rash to pronounce upon this circumstance. If *Leibnitz* had confined himself to a few essays of his new calculus, there might have been some foundation for that suspicion; but the numerous pieces he inserted in the Leipsic Acts, prove the calculus to have received such improvements from him, that probably he owed the invention of it to his genius, and to the efforts he made to discover a method, which put *Newton* in possession of so many beautiful truths. This is so much the more likely, as, from the method of tangents discovered by *Dr Barrow*, the transition to the differential calculus was easy, nor was the step too great for such a genius as that with which *Leibnitz* appears to have been endowed." Such is the opinion of *Montucla*, who being a foreigner, cannot be supposed have been too partial towards *Newton*, an Englishman. The British mathematicians have hitherto, with few exceptions, entertained an opinion still more decidedly in favour of the claims of their celebrated countryman.

* Vol. ii. p. 381.

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It has been said that *Newton* took no share in the controversy; this however seems not to have been exactly the case, for besides suppressing in the third edition of his *Principia* (printed in 1726) the passage we have already quoted, which seems to admit that *Leibnitz* invented his calculus for himself, he is known to have written the notes which accompany the edition of the *Commercium Epistolicum*, printed in 1722. *Leibnitz* had also begun to prepare a *Commercium Epistolicum*, but he died before it was completed.

Besides the disputes that have happened respecting the inventor of the method of fluxions, the accuracy of the method itself has been the subject of controversy, both in Britain and on the continent. The differential calculus was attacked abroad by *Nieuwentiit*, a writer of little or no reputation as a mathematician, and by *Rolle*, who was an expert algebraist, and an indefatigable calculator, but rash, and too confident of the justness of his own opinions, and jealous of the inventions of others. To the first of these writers *Leibnitz* himself replied, and afterwards *Bernoulli* and *Herman*; the attack from *Rolle* was successfully repelled by *Varignon*, who was as zealous and intelligent, as his adversary was warm and impetuous.

The very concise manner in which the great inventor of the method of fluxions thought proper to explain its principles, gave occasion to the celebrated *Dr Berkley* bishop of Cloyne to call in question, not only the logical accuracy of the reasoning employed to establish the theory of fluxions, but also the faith of mathematicians in general, in regard to the truths of religion. The bishop commenced the controversy first in a small work entitled *The Minute Philosopher*; but his principal attack made its appearance in 1734, under the title of "*The Analyst*, or *A Discourse addressed to an Infidel Mathematician*," (understood to be Dr Halley) "*wherein it is examined whether the object, principles, and inferences of the modern Analysis are more distinctly conceived than religious mysteries and points of faith.*" One of the best answers which was made to this work came from the pen of *Benjamin Robins*, and is entitled, "*A discourse concerning the nature and certainty of Sir Isaac Newton's methods of fluxions, and of prime and ultimate ratios.*" Other mathematicians likewise attempted to defend *Newton*, and the method of fluxions, against the very cogent and well-directed arguments of the bishop; but the most satisfactory way of removing all objections to the method, was to abandon those obscure and inaccurate modes of expression, of which *Berkley* had, not without some reason, complained, and to substitute in their place, others more intelligible, and more consonant to the common methods of mathematical reasoning. This was accordingly done by the celebrated *Maclaurin*, who, in the year 1742, published his *Treatise of Fluxions*, a work which, although in some respects rather diffuse, placed the principles of the method beyond controversy, by establishing them on the firm basis of geometrical demonstration.

It would extend this introduction too great a length were we to enter into a detailed account of the various improvements which the calculus has received

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from its firſt invention to the preſent time. We ſhall juſt briefly obſerve, that among thoſe who contributed the firſt and the moſt effectually to its improvement, we may reckon *Newton* and *Leibnitz* themſelves, the two illuſtrious rivals for the honour of its diſcovery; theſe were followed by the two brothers *James* and *John Bernoulli*, by the *Marquis de L'Hopital*, and many other foreign mathematicians; and in this country we may reckon *Craig*, *Cheyne*, *Cotes*, *Taylor*, and *De Moivre*, as among the earlieſt of its improvers. It is to *Cotes* in particular that we are indebted for the diſcovery of the method of finding the fluents of certain rational fractions, a diſcovery which was extended by *De Moivre*, ſo as to form one of the moſt beautiful and complete branches of the theory of fluxions.

Beſides innumerable memoirs on particular branches of the fluxional calculus, which are to be found in academical collections, many diſtinct treatiſes have been written on the ſubject. Some of the moſt valuable of theſe are as follow. *The Method of Fluxions and Infinite Series*, by *Sir Iſaac Newton*. This work was written in Latin, but was not publiſhed till the year 1736, when it was tranſlated into Engliſh, and given to the world, along with a comment, by *Mr Colſon*. *Harmonia Menſurarum*, by *Cotes*, a moſt valuable and original work, publiſhed in 1716. *A Treatiſe on Fluxions, in two books*, by *Mauclaurin*, publiſhed in 1742. Many parts of the writings of the celebrated *Euler* have a reference to the theory of fluxions, or the differential and integral calculi. He has, however, three works in particular that relate to that ſubject; the firſt is his *Introductio in Analysin Infinitorum*, the ſecond his *Inſtitutiones Calculi Differentialis*, and the third his *Inſtitutiones Calculi Integralis*.

There is a work on this ſubject which deſerves to be particularly mentioned, both on account of its excellence, and the ſingular circumſtance of its being compoſed by a lady. Its title is, *Analytical Inſtitutions, in four books, originally written in Italian, by Donna Maria Gaetana Agneſi*. This lady was Profeſſor of Mathematics and Philoſophy in the Univerſity of Bologna; her work was originally publiſhed in 1748, and has been ſtyled by her countryman *Friſi*, *Opus nitidiſſimum, ingenioſiſſimum, et certe maximum quod adhuc ex fœminæ alicujus calamo prodierit*. A part of this work has been publiſhed in the French language by Boſſut. An Engliſh tranſlation was prepared for the preſs many years ago by the late *Profeſſor Colſon*; it remained, however, unpubliſhed, and might ſtill have continued ſo, but for the liberality of *Baron Maſeres*, who, after ſatisfying ſome pecuniary claims upon the manuſcript, cauſed it, in 1801, to be publiſhed (we believe at his own expence), in two volumes quarto. *The Doctrine and Application of Fluxions, by Thomas Simpſon*, is a work deſervedly in high eſtimation. *The Doctrine of Fluxions, by Emerſon*, is alſo very generally read by the Britiſh mathematicians. We are ſorry, however, to obſerve, that there is no work in the Engliſh language that exhibits a complete view of the theory of fluxions, with all the improvements that have been made upon it to the preſent time. We cannot at preſent acquire any tolerable acquaintance with the ſubject, without conſulting the writings of the foreign mathematicians. There are ſeveral excellent works in the French language; we may mention in particular a *Traité de Calcul Differentiel et de Calcul Integral*, by *Couſin*, in 2 vols. 4to.; another by *Boſſut*, in 2 vols. 8vo.; and another by *La Croix*, in 3 vols. 4to. This laſt deſerves particular notice, as the author intended it to comprehend the ſubſtance of the various valuable treatiſes by *Euler*, as well as of the moſt important academical memoirs that relate to this ſubject. The author has alſo publiſhed an abridgment of his work, in one volume octavo. *Principiorum Calculi Differentialis et Integralis*, by *L'Huilier*, publiſhed in 1795, contains a very clear expoſition of the principles of the calculus. The writings of our countrymen *Landen* and *Waring*, and of theſe foreign mathematicians *La Grange*, *Le Gendre*, *La Place*, and many others, abound with improvements in the calculus. Having given this ſketch of the hiſtory of this very important branch of mathematical ſcience, we proceed to explain its principles.

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PART I. THE DIRECT METHOD OF FLUXIONS.

Sect. I. *Principles and Definitions.*

1. In the application of algebra to the theory of curve lines, we find that ſome of the quantities which are the ſubject of conſideration, may be conceived as having always the ſame magnitude, as the parameter of a parabola, and the axes of an ellipſe or hyperbola; while others again are indefinite in reſpect of magnitude, and may have any number of particular values, ſuch are the co-ordinates at any point in a curve line. This difference in the nature of the quantities which are compared together, has equally place in various other theories, both in pure and mixed mathematics, and it naturally ſuggeſts the diviſion of all quantities whatever into two kinds, namely, ſuch as are conſtant, and ſuch as are variable.

2. A *conſtant* quantity is that which retains always the ſame magnitude, however other quantities with which it is connected may be ſuppoſed to change; and a *variable* quantity is that which is indefinite in reſpect of magnitude, or which may be ſuppoſed to change its value. Thus, in the arithmetic of fines, the radius is a conſtant quantity, while the co-fine, ſine, tangent, &c. of an arch, alſo the arch itſelf, are variable quantities; and in the conic ſections the axes and the parameters of the axes are conſtant quantities, and any abſciſſa and its correſponding ordinate are variable quantities.

Conſtant quantities are uſually denoted by the firſt letters of the alphabet a, b, c, &c. and variable quantities by the laſt letters z, y, x, &c.

3. Any expreſſion of calculation, containing a variable quantity, along with other conſtant quantities, is called a *Function* of that variable quantity. Thus, ſuppoſing x to be variable, and the other quantities conſtant, any

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any one of these expressions ax^n, $\frac{a+bx^m}{cx^n+dx^k}$, a^x, *log.* x, *cos.* x, *sin.* x, &c. is a function of x; and in any such equation as $y=ax+bx+bx^2+cx^3$, the quantity y is called a function of x. Even although the variable quantities x and y, should not be separated as in the last example, but should be related to each other as in the following

$$ax^3y+bxy^3+y^3=0,$$

as, setting aside the consideration of the constant quantities, the value of y depends on that of x, and on the contrary the value of x depends upon that of y, the quantity y is said to be a function of x, and on the other hand x is said to be a function of y.

4. If a variable quantity be supposed to change its value, then a corresponding change will take place in the value of any function of that quantity. Let us examine the nature of this change in the magnitude of a function.

First, let us suppose that, x denoting any variable quantity, the function to be considered is any integer power of that quantity, as x^2, or x^3, or x^4, &c.; then, x being supposed to be increased by an indefinite quantity h, and thus to become $x+h$, the function will change its value; if it be x^2 it will become $(x+h)^2$, or

$$x^2+2xh+h^2;$$

and if it be x^3 it will become $(x+h)^3$ or

$$x^3+3x^2h+3xh^2+h^3;$$

and if it be x^4 it will become $(x+h)^4$, or

$$x^4+4x^3h+6x^2h^2+4xh^3+h^4;$$

and so on, for other integer powers.

If we compare the new value of the function in each of these cases with its former value, it will immediately appear, that the new value may be resolved into two parts, one of which is the original value of the function, and, therefore, the other is the increment which the function has received, in consequence of the change in the value of the variable quantity x. Thus, the function being x^2, we have found its new value to be $x^2+2xh+h^2$, of which expression, the first term x^2 is the original value of the function; therefore the other part of the expression viz. $2xh+h^2$ is its increment. In like manner the expression $x^3+3x^2h+3xh^2+h^3$, which is the new value of the function x^3, may be resolved into x^3, the original value of the function, and $3x^2h+3xh^2+h^3$ its increment; and $x^4+4x^3h+6x^2h^2+4xh^3+h^4$, the new value of the function x^4, may be resolved into x^4, the function itself, and $4x^3h+6x^2h^2+4xh^3+h^4$ its increment.

5. Having seen that, by conceiving the variable quantity x to receive the indefinite increment h, the functions x^2, x^3, x^4 receive the increments

$$2xh+h^2,$$
$$3x^2h+3xh^2+h^3,$$
$$4x^3h+6x^2h^2+4xh^3+h^4,$$

respectively, we next observe that each increment is expressed by a series, the first term of which is the first power of the indefinite quantity h multiplied by some function of the variable quantity x as a co-efficient. The second term of the series consists of the second power of h, multiplied also by a function of x as a co-efficient; and, in like manner, the third and following terms are composed of the third and higher powers of h (the exponents forming the arithmetical series 1, 2, 3, 4, &c.) each multiplied by a function of x, as a coefficient; and it appears, that the particular form of the function which constitutes the coefficient of any assigned term of the series depends entirely upon the particular form of the original function. Thus, when the original function is x^2, the function which is the coefficient of the first term is $2x$; when the original function is x^3, the co-efficient of the first term is $3x^2$; when the original function is x^4, the coefficient of the first term is $4x^3$, and so on. It also appears that the functions of x, which are the coefficients of the powers of h, are composed only of the variable quantity x and given quantities, so that they are entirely independent of the indefinite increment h.

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6. These observations may be extended to a function that is any power whatever of a variable quantity, by the application of the binomial theorem. Let x be supposed to become $x+h$, then x^n will become $(x+h)^n$; but by the binomial theorem, (see ALGEBRA, Sect. xvii.) $(x+h)^n$ when expanded into a series, is

$$x^n+\frac{n}{1}x^{n-1}h+\frac{n(n-1)}{1\cdot 2}x^{n-2}h^2$$
$$+\frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}h^3+\&c.$$

where it appears, that the first term of the series is the original value of the function, and the following terms are the first, second, and following powers of the increment h, each multiplied by a new function of x, that is independent of the increment. Let us denote the functions nx^{n-1}, $\frac{n(n-1)}{1\cdot 2}x^{n-2}$, and $\frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}$, &c. by p, q, r, &c. respectively, and it is to be observed that, in the present case, as well as in the case of any other function of x we may hereafter consider, by the letters p, q, r, &c. or the same letters with accents over them, or lastly the capital letters P, Q, R, &c. we do not mean to denote functions of x of any particular form, but functions of x in general, that consist only of x and given quantities. This being kept in view, it appears that the variable quantity x being supposed to change its value, and to become $x+h$, the function x^n changes its value, so as to become

$$x^n+ph+qh^2+rh^3+sh^4+, \&c.$$

a series, the terms of which have the properties already explained in the two preceding sections.

7. Every rational and integer function of a variable quantity x is necessarily of this form

$$Ax^\alpha+Bx^\beta+Cx^\gamma+\&c.$$

where A, B, C, &c, and α, β, γ, are supposed to denote constant quantities.

Let us examine what is the form which the function assumes when the variable quantity x changes its value

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to $x+h$, and to avoid complicated expreſſions, let us ſuppoſe the function to conſiſt of theſe two terms $Ax^{\alpha}+Bx^{\beta}$. We have already found in laſt ſection that x being ſuppoſed to become $x+h$, x^{α} will become

$$x^{\alpha}+p\,h+q\,h^2+r\,h^3+\&c.$$

where p, q, r, &c. denote functions of x independent of h, as explained in the laſt ſection, and conſequently Ax^{α} will become

$$Ax^{\alpha}+Ap\,h+Aq\,h^2+Ar\,h^3+\&c.$$

In like manner Bx^{β} will become

$$Bx^{\beta}+Bp'\,h+Bq'\,h^2+Br'\,h^3+\&c.$$

p', q', r', &c. denoting alſo functions of x independent of h; therefore, taking the ſum of the two ſeries, it appears that, ſuppoſing x to change its value, and to become $x+h$, the function $Ax^{\alpha}+Bx^{\beta}$ becomes

$$Ax^{\alpha}+Bx^{\beta}+(Ap+Bp')\,h+(Aq+Bq')h^2+(Ar+Br')\,h^3+\&c.$$

now p and p' being functions of x, $Ap+Bp'$ will alſo be a function of x, and may be denoted more ſimply by P, and for the ſame reaſon $Aq+Bq'$, $Ar+Br'$, &c. which are functions of x, may be denoted by Q, R, &c. thus the expreſſion for the new value of $Ax^{\alpha}+Bx^{\beta}$ is

$$Ax^{\alpha}+Bx^{\beta}+P\,h+Q\,h^2+R\,h^3+\&c.$$

a ſeries, the form and properties of which are in all reſpects analogous to thoſe of the ſeries that expreſſes the new value of the function x^n; and although we have ſuppoſed the function to conſiſt of but two terms, yet it is obvious, that whatever be the number of terms, ſtill the form of the ſeries and its properties will be the ſame; that is, it will conſiſt of two parts, one of which is independent of h, and is the original value of the function, and the other is a ſeries, the terms of which are the ſucceſſive powers of the increment h, each multiplied by a function of the variable quantity x as a co-efficient. This concluſion may be expreſſed in ſymbols conciſely thus. Let u denote any rational and integer function of a variable quantity x, let x be conceived to change its magnitude, and to become $x+h$, and let u' denote the new value which the function acquires in conſequence of the change in the value of x, then

$$u'=u+p\,h+q\,h^2+r\,h^3+,\ \&c.$$

where p, q, r, &c. denote functions of x as already ſtated.

8. Suppoſe next the function of x to be of this form:

$$(Ax^{\alpha}+Bx^{\beta}+Cx^{\gamma}+\&c.)^n,$$

that is, ſuppoſe it to be the nth power of a polynomial, conſiſting of any number of terms whatever. Let the expreſſion between the parentheſis be denoted by v, then we are to conſider the function v^n. Now when x becomes $x+h$, we have already found that v becomes

$$v+p\,h+q\,h^2+r\,h^3+\&c.$$

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therefore v^n will become

$$(v+p\,h+q\,h^2+r\,h^3+\&c.)^n,$$

or, putting $p\,h+q\,h^2+r\,h^3+\&c.=M$,

v^n will become $(v+M)^n$,

and this expreſſion when expanded into a ſeries by the binomial theorem is

$$v^n+a\,v^{n-1}M+b\,v^{n-2}M^2+c\,v^{n-3}M^3+\&c.$$

where a, b, c, &c. expreſs numbers.

Now from the form of the ſeries denoted by M, it is manifeſt that its ſquare, cube, or any power of it whatever, will be a ſeries proceeding by the powers of h, and having for the coefficients of its terms certain combinations of the quantities p, q, r, &c. which being functions of x, any combinations of them will alſo be functions of x. Therefore, each of the terms of the above ſeries, expreſſing the developement of $(v+M)^n$, excepting the firſt term v^n, will itſelf be a ſeries proceeding by the powers of h, and having its terms multiplied by functions of x, and conſequently their ſum will be a ſeries of the ſame nature. Let us as before denote the functions of x, which are the coefficients of the ſucceſſive powers of h by P, Q, R, &c. and we ſhall have upon the whole

$$(v+p\,h+q\,h^2+r\,h^3+\&c.)^n$$

expreſſed by a ſeries of this form

$$v^n+P\,h+Q\,h^2+R\,h^3+\&c.$$

therefore, putting the ſingle letter u for the function u^n, or for

$$(Ax^{\alpha}+Bx^{\beta}+Cx^{\gamma}+\&c.)^n$$

and u' for the new value which u acquires by x changing its value to $x+h$,

$$u'=u+P\,h+Q\,h^2+R\,h^3+\&c.$$

a ſeries of the ſame nature as before.

9. Let us now conſider a fractional function of x, and let us ſuppoſe it to be

$$\frac{A'x^{\alpha'}+B'x^{\beta'}+C'x^{\gamma'}+\&c.}{Ax^{\alpha}+Bx^{\beta}+Cx^{\gamma}+\&c.}$$

Where A', A, B', B, &c. alſo α', α, β', β, &c. denote conſtant quantities. Let v denote the numerator of the fraction, and w its denominator, then the function is

$$\frac{v}{w},\ \text{or}\ v\,w^{-1},$$

now when x becomes $x+h$, v becomes

$$v+p\,h+q\,h^2+r\,h^3+\&c.$$

and w^{-1} becomes

$$w^{-1}+p'\,h+q'h^2+r'\,h^3+\&c.$$

and conſequently $v\,w^{-1}$ becomes

$$(v+p\,h+q\,h^2+\&c.)(w^{-1}+p'\,h+q'\,h^2+\&c.)$$

and

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and the product of these two factors, by actual multiplication is

$$\left.\begin{matrix} v\,w^{-1}+v\,p' \\ +w^{-1}p \end{matrix}\right\} h \left\{\begin{matrix} +v\,q' \\ +p\,p' \\ +w^{-1}q \end{matrix}\right\} h^2+\text{ \&c.}$$

Now, here as before, it appears that the coefficients of the powers of h are functions of x, therefore, denoting these functions by P, Q, R, &c. and observing that $v\,w^{-1}$ is $\frac{v}{w}$, we have the new value of $\frac{v}{w}$ expressed by by the series

$$\frac{v}{w}+\mathrm{P}\,h+\mathrm{Q}\,h^2+\mathrm{R}\,h^3+\text{ \&c.}$$

or, substituting the single letter u for $\frac{v}{w}$, that is, for

$$\frac{\mathrm{A}'\,x^{\alpha'}+\mathrm{B}'\,x^{\beta'}+\mathrm{C}'\,x^{\gamma'}+\text{ \&c.}}{\mathrm{A}\,x^{\alpha}+\mathrm{B}\,x^{\beta}+\mathrm{C}\,x^{\gamma}+\text{ \&c.}}$$

and putting u' for the value that u acquires when x becomes $x+h$,

$$u'=u+\mathrm{P}\,h+\mathrm{Q}\,h^2+\mathrm{R}\,h^3+\text{ \&c.}$$

a series in all respects analogous to those already found for the other functions of x.

10. In the functions which we have hitherto considered, the exponents of the powers of x were constant quantities. Let us now consider a function in which the exponent is the variable quantity x itself.

Suppose then the function to be a^x, where a denotes a given number; then, by supposing x to become $x+h$, the function will become

$$a^{x+h}=a^x\,a^h.$$

Now it has been shown in the article ALGEBRA, § 295, that if A be put to denote the quotient arising from the division of a logarithm of a by the logarithm of 2·7182818··· the exponential quantity a^h is expressed by the series

$$1+\frac{\mathrm{A}}{1}h+\frac{\mathrm{A}^2}{1\cdot 2}h^2+\frac{\mathrm{A}^3}{1\cdot 2\cdot 3}h^3+\text{ \&c.}$$

therefore, a^{x+h}, the new value of the function is

$$a^x\left(1+\frac{\mathrm{A}}{1}h+\frac{\mathrm{A}^2}{1\cdot 2}h^2+\frac{\mathrm{A}^3}{1\cdot 2\cdot 3}h^3+\text{ \&c.}\right),$$

this series, by multiplying all its terms by a^x, and putting p, q, r, &c. for that part of each term which is independent of h, becomes

$$a^x+p\,h+q\,h^2+r\,h^3+\text{ \&c.}$$

so that denoting the function a^x by u, and its new value by u',

$$u'=u+p\,h+q\,h^2+r\,h^3+\text{ \&c.}$$

a series of the same form as the others.

11. From a due consideration of what has been shewn relating to the change that takes place in the magnitude of a variable function, corresponding to the change that takes place in the magnitude of the variable quantity from which the function is formed, we may conclude the truth of the following general proposition to be sufficiently established.

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Let x *denote a variable quantity, and* u *any function whatever of that quantity, let* x *be supposed to receive any increment* h, *and thus to become* x+h, *and let* u' *be the new value which the function acquires by the change in the value of* x, *then, the new value of* u *may in every case be expressed thus:*

$$u'=u+p\,h+q\,h^2+r\,h^3+\text{ \&c.}$$

where p, q, r, &c. *denote quantities that are quite independent of* h, *and consequently can only involve the variable quantity* x, *and given quantities.*

12. Having examined what is the general form that any function of a variable quantity acquires by a change in the value of that quantity, and found it to be a series, the first term of which is always the function itself, it is evident that the remaining terms will express the increment that the function receives, in consequence of the change in the magnitude of the variable quantity from which the function is formed. Let us now compare the simultaneous increments of a variable quantity and its function with each other, and that we may at first avoid general reasoning, and fix the mind more completely, let us suppose the functions to have a determinate form, as x^2, x^3, x^4, &c.

Putting u and u' as before to denote the two succeeding values of the function, first let it be supposed that $u=x^2$, then x being supposed to receive the indefinite increment h, and thus to become $x+h$, and u to change its value to $u'=(x+h)^2$, we have

$$u'=x^2+2\,x\,h+h^2,$$

or, $u'=u+2\,x\,h+h^2$,

and consequently

$$u'-u=2\,x\,h+h^2.$$

Thus it appears, that the simultaneous increments of x and x^2 (or u) are h and $2\,x\,h+h^2$, respectively. Let us now compare these increments, not in respect of their absolute magnitudes, but in respect of their ratio to each other, thus we shall have the increment of u to the increment of x, as $2\,x\,h+h^2$ to h, that is, (dividing the two last terms of the proportion by h) as $2\,x+h$ to 1. Or, instead of employing an analogy, let us, for the sake of brevity, and in conformity to the algebraic notation, rather express each of these ratios by the quotient arising from the division of the antecedents of the ratio by its consequents, and put the results equal to each other. Then, observing that the symbol $u'-u$, which expresses the difference between the succeeding values of the function, may be employed to denote its increment, we have

$$\frac{u'-u}{h}=\frac{2\,x\,h+h^2}{h}=2\,x+h.$$

Hence it appears that the expression for the ratio of the increment of the function u to the increment of the variable quantity x is made up of two parts, one of these, viz. $2\,a\,x$, is quite independent of h, the increment of x, and the other is in the present case that increment itself. In consequence of this peculiarity in the form

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form of the expreſſion for the ratio, it is evident that if the increment h be conceived to be continually diminiſhed, the part of the expreſſion which conſiſts of h will continually diminiſh, ſo that the whole expreſſion, viz. $2x+h$, may become more nearly equal to its firſt term $2x$ than by any aſſignable difference; therefore $2x$ may be conſidered as the *limit* of the ratio $\frac{u'-u}{h}$, that is, a quantity to which the ratio may approach nearer than by any aſſignable difference, but to which it cannot be conſidered as becoming abſolutely equal.

Let us next ſuppoſe that $u=x^3$, then x being ſuppoſed to become $x+h$, we have $u'=(x+h)^3$, $=x^3+3x^2h+3xh^2+h^3$, or

$$u'=u+3x^2h+3xh^2+h^3,$$

and conſequently

$$u'-u=3x^2h+3xh^2+h^3,$$

$$\text{and } \frac{u'-u}{h}=3x^2+3xh+h^2.$$

Here it is evident, as in the former caſe, that the expreſſion for the ratio $\frac{u'-u}{h}$ is compoſed of two parts, one of theſe, viz. the firſt term $3x^2$, is a function of x that is independent of the increment h, but the other, viz. $3xh+h^2$, or $h(3x+h)$, is the product of two factors, one of which is the increment itſelf. From the particular form of this latter part of the expreſſion for the ratio, it is plain, that h being ſuppoſed to be continually diminiſhed, that part will alſo diminiſh, and may become leſs than any aſſignable quantity. Therefore in this caſe, as well as in the former, the ratio $\frac{u'-u}{h}$ has a *limit*, and that limit is the firſt term of the general expreſſion for the ratio, namely the quantity $3x^2$.

Suppoſe, next, that $u=x^4$, and conſequently

$$u'=(x+h)^4=x^4+4x^3h+6x^2h^2+4xh^3+h^4,$$

or,

$$u'=u+4x^3h+6x^2h^2+4xh^3+h^4,$$

$$\text{and } \frac{u'-u}{h}=4x^3+h(6x^2+4xh+h^2).$$

Here, as in the two former caſes, we have only to inſpect the general expreſſion for the ratio $\frac{u'-u}{h}$ to diſcover, that by ſuppoſing h to be continually diminiſhed, the latter part of the expreſſion, viz. $h(6x^2+4xh+h^2)$, and which comprizes all the terms except the firſt, will become ſmaller than any aſſignable quantity; and conſequently, that the firſt term $4x^3$ is the limit of the ratio.

13. It is eaſy to ſee that the property which we have found to belong to the ratio of the ſimultaneous increments of a variable quantity, and its function in theſe three particular caſes, is an immediate conſequence of the form of the expreſſion for the increment of the function, ſo that it is not peculiar to the functions x^2, x^3, and x^4, but belongs equally to all functions whatever.

For we have found, § 11, that u being ſuppoſed to denote any function of a variable quantity x, as for example, ax^n, or ax^m+bx^n+ &c, or

$$\frac{ax^m+bx^n+\text{ \&c.}}{a'x^{m'}+b'x^{n'}+\text{ \&c.}}$$

and u' being put for the new value which the function acquires when x becomes $x+h$,

$$u'=u+ph+qh^2+rh^3+\text{ \&c.}$$

where p, q, r, &c. denote functions of x that are independent of h, therefore,

$$u'-u=ph+qh^2+rh^3+\text{ \&c.}$$

and

$$\frac{u'-u}{h}=p+qh+rh^2+\text{ \&c.}$$

or,

$$\frac{u'-u}{h}=p+h(q+rh+\text{ \&c.})$$

Thus it appears, that whatever be the form of the function, the ratio $\frac{u'-u}{h}$ is always expreſſed by a quantity which may be reſolved into two parts; one of theſe, viz. p, is independent of the increment h, and the other, viz. $h(q+rh+$ &c.), is the product of h by a ſeries, the firſt term of which is a function of x, and the remaining terms alſo functions of x multiplied by the firſt, ſecond, third, and higher powers of h. Now from the particular form of this laſt part of the general expreſſion for the ratio, it is manifeſt, that h being conceived to be continually diminiſhed, the quantity $h(q+rh+$ &c.) will alſo be continually diminiſhed, and may become leſs than any aſſignable quantity; therefore, the limit of the ratio $\frac{u'-u}{h}$ is ſimply p, that is, the function of x, which is the coefficient of the firſt or ſimple power of h in the general expreſſion for the increment.

14. From what has been juſt ſhewn, we may infer the truth of the following general propoſition relative to the ſimultaneous changes that take place in a variable quantity and its function.

Let x *denote a variable quantity and* u *any function of that quantity. let* x *be conceived to change its value and become* x+h, *where* h *denotes an arbitrary increment, and let* u' *denote the new value that the function acquires, in conſequence of the change in the magnitude of* x. *Then, obſerving that* h *and* u'—u *are the ſimultaneous increments of the variable quantity and its function, if* h *be conceived to be continually diminiſhed, the ratio* $\frac{u'-u}{h}$ *will continually approach to a certain Limit, which will be different for different functions, but always the ſame for the ſame function, and in every caſe quite independent of the magnitude of the increments.*

The ratio which is the *limit* of the ratio of the increments, when theſe increments are conceived to be continually diminiſhed, may be called the *limiting ratio* of the increments.

15. The analytical fact contained in the preceding propoſition affords the foundation for a mathematical theory of great extent, and which may be divided into

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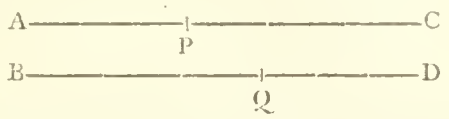
into two diſtinct branches; one having for its object the reſolution of the following problem. *Having given the relation of any number of variable quantities to each other, to determine the limiting ratios of their increments*; and the other the converſe of that problem, namely, *Having given the limiting ratios, to determine the relations of the quantities themſelves.*

The theory to which we have alluded conſtitutes the METHOD of FLUXIONS, and in explaining the foundation of the method, we have endeavoured to ſhow, that it reſts upon a principle purely analytical, namely the theory of limiting ratios; and this being the caſe, the ſubject may be treated as a branch of pure mathematics, without having occaſion to introduce any ideas foreign to geometry.

16. Sir Iſaac Newton, however, in firſt delivering the principles of the method, thought proper to employ conſiderations drawn from the theory of motion. But he appears to have done this chiefly for the purpoſe of illuſtration, for he immediately has recourſe to the theory of limiting ratios, and it has been the opinion of ſeveral mathematicians of great eminence (A) that the conſideration of motion was introduced into the method of fluxions at firſt without neceſſity, and that ſucceeding writers on the ſubject ought to have eſtabliſhed the theory upon principles purely mathematical, independent of the ideas of time, and velocity, both of which ſeem foreign to inveſtigations relating to abſtract quantity.

17. That we may conform to the uſual method of treating this ſubject, we proceed to ſhow how the theory of motion is commonly applied to the illuſtration of the nature of variable quantities, and of the relations that reſult from their being conceived to change their value.

As quantities of every kind, if we abſtract from their poſition, figure, and ſuch affections, and conſider their magnitude only, may be repreſented by lines, we may conſider a variable quantity x, and u any function of that quantity, to be repreſented by two lines AP, BQ, which have A, B, one extremity of each given, and which vary by the points P, Q, their other extremities, moving in the directions AC, BD, while the equation expreſſing the relation between x and u, or their repreſentative lines AP, BQ, remains always the ſame.



18. The lines AP, BQ being thus conceived to vary, the relation that is ſuppoſed always to ſubſiſt between them, in reſpect of their magnitudes, will neceſſarily give riſe to another relation, namely, that which will conſtantly ſubſiſt between the velocities of the moving points P and Q, by which the lines are generated.

With a reference to this particular mode of conceiving variable quantities to exiſt, the quantities themſelves have been called *flowing quantities* or *fluents*, and the meaſures of the velocities with which the variable quantities increaſe have been called their *fluxions*.

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19. To ſimplify the hypotheſis, we may ſuppoſe that the point which generates the line AP, or x, moves uniformly; thus the meaſure of its velocity, or the fluxion of x, will be a given quantity, with which the meaſure of the velocity of the point Q, or the fluxion of u, may be continually compared. To determine then the fluxions, or rather the ratio of the fluxions of x a variable quantity, and u, any function of that quantity, is in effect to reſolve the following problem.

Having given an equation expreſſing the relation at every inſtant between the ſpace paſſed over by two points, one of which moves with an uniform velocity. It is required to find an expreſſion for the ratio that the meaſures of the velocities have at every inſtant to each other.

20. Now it is a fundamental principle in the theory of motion, reſulting indeed from the very nature of a variable velocity, that when two velocities are compared together, whether they be both variable, or one of them uniform, and the other variable, *the meaſures of their velocities are any quantities having to each other the ratio that is the limit of the ratio of the ſpaces deſcribed in the ſame time, when thoſe ſpaces are conceived to be continually diminiſhed.* And hence it follows that the ratio of the fluxions of two variable quantities is no other than the limiting ratio of their ſimultaneous increments.

That the theory of motion may be applied to the generation of variable algebraic quantities, we have ſuppoſed them to be repreſented by lines; this however is not neceſſary, if the variable quantities are themſelves geometrical magnitudes; for like as a line is conceived to be generated by the motion of a point, ſo a ſurface may be conſiderated as generated by the motion of a line, a ſolid by the motion of a ſurface, and an angle by the rotation of one of the lines which contain it; and the fluxions of thoſe quantities at any inſtant, or poſition, will be the meaſures of the velocities, or degrees of ſwiftneſs, according to which they increaſe at that inſtant or poſition.

But in every caſe the ratio of the rates of increaſe, or fluxions of two homogeneous magnitudes, will be the limiting ratio of their ſimultaneous increments.

21. Having thus found that by conceiving variable quantities as generated by motion, and taking their velocities, or rates of increaſe, as an object for the mind to contemplate and reaſon on, we are in the end led to the conſideration of the limiting ratios of their increments, a ſubject which is purely mathematical, and independent of the ideas of time or velocity, we ſhall exchange the definition of a fluxion given in § 18, which involves thoſe ideas, for another that reſts entirely upon the exiſtence of limiting ratios.

By the fluxions then of two variable quantities having any aſſigned relation to each other, we are in the following treatiſe always to be underſtood to mean *any*

(A) Such as *Lagrange*, *Couſin*, *La Croix*, &c. abroad, and *Landen* in this country.

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indefinite quantities which have to each other the limiting ratio of their ſimultaneous increments (B).

In conformity to this definition of fluxions it is evident that we are to conſider them, not as abſolute, but as relative quantities, which derive their origin from the compariſon of variable quantities with each other in reſpect of their ſimultaneous variations of magnitude.

22. Sir Iſaac Newton employed different ſymbols at different times to denote the fluxions of variable quantities. It is now however common in Britain to denote them by the ſame letters employed to expreſs the quantities themſelves, and each having a dot over it. Thus $\dot{x}$ denotes the fluxion of the variable quantity expreſſed by x, and in the like manner $\dot{u}$, $\dot{v}$, $\dot{z}$, denote the fluxions of the variable quantities u, v, z, reſpectively.

23. Suppoſe now that u is any function of a variable quantity x, and that the limiting ratio of the ſimultaneous increments of u and x is the ratio of p to 1, where p denotes ſome other function of x, then, from the definition juſt given of fluxions, we have

$$\frac{\dot{u}}{\dot{x}} = p, \text{ and } \dot{u} = p\dot{x}$$

Hence it follows as a conſequence of the preceding definition, that the fluxion of u, any function of a variable quantity x, is *the product ariſing from the multiplication of that function of x which is the expreſſion for the limiting ratio of the increments by the fluxion of the variable quantity x itſelf.*

Sect. II. *Inveſtigation of the Rules of the Direct Method of Fluxions.*

24. The method of fluxions naturally reſolves itſelf into two parts, as we have already obſerved, § 15. We proceed to explain the firſt of theſe, which is called the *Direct Method*, and which treats of finding the ratios of the fluxions of variable quantities, having given the relations of thoſe quantities to each other.

25. We ſhall begin with inveſtigating the ratio of the fluxions of two variable quantities in that particular caſe, when one of them is any power of the other.

Let us ſuppoſe then, that u is ſuch a function of a variable quantity x, that $u = x^n$, where n denotes any number whatever, it is required to determine the ratio of the fluxions of u and x.

If we recur to the definition which has been given of the fluxions of variable quantities in § 21, it will appear that we have in effect reſolved the problem juſt propoſed in three particular caſes, when treating of the limiting ratios of the increments of variable quantities. For it has been ſhown in § 12. that when $u = x^2$, and x is ſuppoſed to change its value, ſo as to become $x+h$, where h denotes an indefinite increment, and in conſequence of this change in the magnitude of x, u alſo changes its value, and becomes u', then, obſerving that $u'-u$ and h are the ſimultaneous increments of u and x, the limiting ratio of $\frac{u'-u}{h}$ is $2x$. Let this expreſſion for the limiting ratio be put equal to the ratio of the fluxions of u and x, that is to $\frac{\dot{u}}{\dot{x}}$, thus we have $\frac{\dot{u}}{\dot{x}} = 2x$, and $\dot{u} = 2x\dot{x}$. Hence it appears that whatever be the magnitude of the quantity that expreſſes the fluxion of x, the fluxion of u or x^2 will be expreſſed by the fluxion of x multiplied by $2x$.

Again, when $u = {}^3x$, and u', $u'-u$ and h denote the ſame as before, it has been ſhown, § 12, that the limiting ratio of $\frac{u'-u}{h}$ is $3x^2$, therefore, § 21, $\frac{\dot{u}}{\dot{x}} = 3x^2$, and $\dot{u} = 3x^2\dot{x}$; that is, the fluxion of x^3 is expreſſed by the fluxion of x multiplied by $3x^2$.

And when $u = x^4$ it has been ſhown, § 12, that the limiting ratio of $\frac{u'-u}{h}$ is $4x^3$. Therefore, § 21, $\frac{\dot{u}}{\dot{x}} = 4x^3$ and $\dot{u} = 4x^3\dot{x}$.

To reſolve the problem generally, or when $u = x^n$, let us ſuppoſe x to become $x+h$, and u to become u', then $u' = (x+h)^n$. But this laſt quantity, when expanded into a ſeries by the binomial theorem (Algebra, Sect. XVII.) is

$$x^n + p\,h + q\,h^2 + r\,h^3 + \&c.$$
$$\text{or } u + p\,h + h^2\,(q + r\,h + \&c.),$$

where p, q, r, &c. denote functions of x, indpendent of h. Therefore,

$$u' - u = p\,h + h^2\,(q + r\,h + \&c.),$$
$$\text{and } \frac{u'-u}{h} = p + h\,(q + r\,h + \&c.)$$

Therefore, ſuppoſing h to be continually diminiſhed, the limit of $\frac{u'-u}{h}$ is p; but, whatever be the nature of the exponent n, p is always $n\,x^{n-1}$, (Algebra, § 267.), therefore, the limit of $\frac{u'-u}{h}$ is $n\,x^{n-1}$, and conſequently $\frac{\dot{u}}{\dot{x}} = n\,x^{n-1}$, and $\dot{u} = n\,x^{n-1}\dot{x}$.

26. As we ſhall have frequently occaſion to employ the reſult of this inveſtigation, it will be proper to expreſs it in the form of a practical rule, thus.

To find the fluxion of any power of a variable quantity. Multiply the fluxion of the variable quantity itſelf by the exponent of the power, and by a power of the quantity whoſe exponent is leſs by unity than the given exponent, and the product will be the fluxion required.

27.

(B) We are here to be underſtood to mean the ratio of the *numerical* values of the increments, which may always be compared with each other, whether the variable quantities be of the ſame kind, as both lines, or both ſurfaces, &c. or of different kinds, as the one a line, and the other a ſurface.

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27. In determining the limit of the ratio of the ſimultaneous increments of x and x^n, we have referred to the binomial theorem, but the only application we have had occaſion to make of that theorem was to determine the numeral coefficient of the ſecond term of the developement of $(x+h)^n$, when n is ſuppoſed to be any number whatever, which is an inquiry of a more ſimple nature than the general inveſtigation of the theorem. We ſhall now ſhow how that coefficient may be deduced from the firſt principles of algebra. Thus the inveſtigation of the fluxion of x^n will be rendered independent of the general demonſtration of the binomial theorem; and we ſhall hereafter ſhow that the theorem itſelf is eaſily inveſtigated by the direct method of fluxions.

28. Since $x+h$ is equal to $x\left(1+\frac{h}{x}\right)$ it follows that $(x+h)^n=x^n\left(1+\frac{h}{x}\right)^n$, thus the development of $(x+h)^n$ is reduced to that of $\left(1+\frac{h}{x}\right)^n$, or putting $\frac{h}{x}=v$, to $(1+v)^n$. Now if we give particular values to n, and ſuppoſe it to be 1, 2, 3, &c. or -1, -2, &c. or laſtly $\frac{1}{2}$, $\frac{1}{3}$, &c. we can find the ſeries that expreſs the powers of $1+v$, whoſe exponents are thoſe numbers, by the operations of multiplication, diviſion, and evolution, and in every particular caſe we ſhall find, that the powers of $1+v$ are expreſſed by a ſeries of this form,

$$1+A\,v+B\,v^2+C\,v^3+D\,v^4+\&c.$$

Where A, B, C, D, &c. denote numeral coefficients which depend for their value only on n the exponent of the power, and not on the quantity v; and as the form of the ſeries will be found to be the ſame whatever particular values we may give to the exponent, we may conclude that it is the ſame, whether the exponent be poſitive or negative, whole or fractional.

29. Firſt let us ſuppoſe that the exponent is a whole poſitive number, then, becauſe

$$(1+v)^n=1+A\,v+B\,v^2+\&c.$$

if we multiply both ſides of this equation by $1+v$, and collect together the like powers of v, it will appear that

$$(1+v)^{n+1}=1\left.\begin{matrix}+A\\+1\end{matrix}\right\}v\left.\begin{matrix}+B\\+A\end{matrix}\right\}v^2+\&c.$$

Hence it appears that the coefficient of the ſecond term of any power of $1+v$ exceeds that of the next leſs power by unity. Now in the caſe of the firſt power of $1+v$, the coefficient of the ſecond term is obviouſly 1, therefore, in the ſecond power it is 2, in the third power 3, and univerſally, in the nth power it is n; ſo that n being a whole poſitive number,

$$(1+v)^n=1+n\,v+\&c.$$

30. Let us next ſuppoſe the exponent to be a fraction denoted by $\frac{m}{n}$, ſo that

$$(1+v)^{\frac{m}{n}}=1+A\,v+B\,v^2+\&c.$$

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Let both ſides of this equation be raiſed to the power n, having firſt ſubſtituted M v for A v+B v^2+ &c. then

$$(1+v)^m=(1+M\,v)^n.$$

Now as we have juſt found that m and n being integers,

$$(1+v)^m=1+m\,v+\&c.$$
$$\text{and } (1+M\,v)^n=1+n\,M\,v+\&c.$$

Here we ſtop at the ſecond term, that being the only one whoſe coefficient is required. Subſtitute now for M v its value A v + &c. then, ſtopping again at the ſecond term, we get

$$(1+M\,v)^n=1+n\,A\,v+\&c.$$

therefore,

$$1+m\,v+\&c.=1+n\,A\,v+\&c.$$

and making the coefficients of v in each ſeries equal to each other,

$$n\,A=m, \text{ and } A=\frac{m}{n}.$$

31. In the laſt place let us ſuppoſe that the exponent is a negative quantity either whole or fractional, ſo that

$$(1+v)^{-\frac{m}{n}}=1+A'v+B'v^2+\&c.$$

$$\text{or } \frac{1}{(1+v)^{\frac{m}{n}}}=1+A'v+B'v^2+\&c.$$

then, multiplying both ſides by $(1+v)^{\frac{m}{n}}$ we get

$$1=(1+v)^{\frac{m}{n}}(1+A'v+B'v^2+\&c.)$$

or, ſubſtituting $1+A\,v+B\,v^2+\&c.$ for $(1+v)^{\frac{m}{n}}$ and actually multiplying the two ſeries,

$$1=1\left.\begin{matrix}+A\\+A'\end{matrix}\right\}v\left.\begin{matrix}+B\\+A\,A'\\+B'\end{matrix}\right\}v^2+\&c.$$

Now that this equation may ſubſiſt, whatever be the value of v, it is neceſſary that

$$A+A'=0,$$
$$B+A\,A'+B'=0,$$
$$\&c.$$

and by theſe equations we may determine A', B', C', &c. It is however only required at preſent to find the firſt of theſe, viz A', now we have $A'=-A$; but A being the coefficient of the ſecond term of the ſeries expreſſing $(1+v)^{\frac{m}{n}}$, the exponent of which is poſitive; we have already found it to be $\frac{m}{n}$, therefore, $A'=-\frac{m}{n}$.

32. As we have found that the coefficients of the ſecond term of the developements of $(1+v)^n$, $(1+v)^{\frac{m}{n}}$ and $(1+v)^{-\frac{m}{n}}$ are m, $\frac{m}{n}$, and $-\frac{m}{n}$ reſpectively, it appears that whatever be the number denoted by n, the two firſt terms of the ſeries expreſſing $(1+v)^n$ are, $1+n\,v$, and therefore, ſubſtituting for v its value $\frac{h}{x}$, and multiplying by x^n, the two firſt terms of the ſeries expreſſing $(x+h)^n$ are $x^n+n\,x^{n-1}h$, agreeing with what we

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have assumed in § 25 as given by the binomial theorem (c).

33. The mode of reasoning employed to determine the ratio of the fluxions of u and x, when the former is a function of the latter of the form x^n, will apply equally when the function has any other assigned form. But instead of investigating in this manner the fluxion of every particular function, it is better to consider a complex function as the sum, or difference, or product or quotient, &c. of other simple functions, and to investigate rules for each of these cases, supposing that the fluxions of the simple functions are previously known.

34. Let us first suppose that u, a function of a variable quantity x, is equal to the sum of v and w, two other functions of x. It is required to find the fluxion of u, having given the fluxions of v and w.

Let x be conceived to change its value, and to become $x+h$, then, as v and w will also change their values, § 11, the one to

$$v'=v+p\,h+q\,h^2+r\,h^3+\&c.$$

and the other to

$$w'=w+p'\,h+q'\,h^2+r'\,h^3+\&c.$$

if u' as usual denote the corresponding new value of u, we have

$$\begin{aligned} u&=v+w\\ u'&=\begin{cases} v+p\,h+q\,h^2+\&c.\\ +w+p'\,h+q'\,h^2+\&c.\end{cases}\\ u'-u&=(p+p')h+(q+q')h^2+\&c.\\ \frac{u'-u}{h}&=p+p'+(q+q')h+\&c.\end{aligned}$$

If we now conceive h to be continually diminished, we shall have the limit of $\frac{u'-u}{h}$ expressed by $p+p'$. But p is the limit of $\frac{v'-v}{h}$, § 14, and in like manner p' is the limit of $\frac{w'-w}{h}$, therefore,

$$\text{limit of } \frac{u'-u}{h} = \text{limit of } \frac{v'-v}{h} + \text{limit of } \frac{w'-w}{h}.$$

Substitute now the ratio of the fluxions instead of the limiting ratios, and we have

$$\frac{\dot u}{\dot x}=\frac{\dot v}{\dot x}+\frac{\dot w}{\dot x};$$

$$\text{therefore,}\quad \dot u=\dot v+\dot w.$$

35. If we suppose s to be a function of x, and u, v, w, &c. other functions of x, such that

$$s=au+b\,v+c\,w+\&c.$$

where a, b, c, denote any given numbers, positive or negative, then, by reasoning as above, it is evident that

$$\dot s=a\,\dot u+b\,\dot v+c\,\dot w+\&c.$$

Therefore, to find the fluxion of the sum of any number of functions, each multiplied by a constant quantity. Multiply the fluxion of each function by its constant coefficient, and the sum of the products is the fluxion required.

36. If c denote a constant quantity, and u v, be functions of x, such, that $u=c+v$; then x being supposed to become $x+h$, and consequently v to become v', or $v+p\,h+q\,h^2+\&c.$ and $c+v$ to become $c+v+p\,h+q\,h^2+\&c.$ we have

$$\begin{aligned} u&=c+v,\\ \text{and } u'&=c+v+p\,h+q\,h^2+\&c.\\ \text{and hence } u'-u&=p\,h+q\,h^2+\&c.\\ \text{or } u'-u&=v'-v,\\ \text{therefore, } \frac{u'-u}{h}&=\frac{v'-v}{h},\end{aligned}$$

and these ratios being always equal, their limits must also be equal; therefore, substituting for the limiting ratios those of the fluxions, we have $\frac{\dot u}{\dot x}=\frac{\dot v}{\dot x}$ and $\dot u=\dot v$; that is to say, the fluxion of $c+v$ is $\dot v$, from which it appears, *That the fluxion of any variable function is the very same as the fluxion of the same function, increased or diminished by any constant quantity.* This is a remark of great importance in the theory of fluxions, as will appear hereafter.

37. Let us now suppose that u, v, w, are functions of x, such, that $u=v\,w$, it is required to find the fluxion of u, supposing the fluxions of v and w to be given.

By supposing that x, u, v and w change their values as usual, we have

$$\begin{aligned} u&=v\,w\\ u'&=(v+p\,h+q\,h^2+\&c.)(w+p'\,h+q'\,h^2+\&c.)\end{aligned}$$

and this last expression by multiplication becomes

$$u'=v\,w+\left.\begin{matrix} v\,p'\,h+v\,q'\,h^2\\ +w\,p\,h+w\,q\,h^2\end{matrix}\right\}+\&c.$$

therefore

$$u'-u=(v\,p'+w\,p)\,h+(v\,q'+w\,q)\,h^2+\&c.$$

dividing now by h, and taking the limit of $\frac{u'-u}{h}$, we have that limit expressed by $v\,p'+w\,p$; but p' is the limit of $\frac{w'-w}{h}$ § 14, and in like manner p is the limit of $\frac{v'-v}{h}$; therefore

the

(c) In this investigation we have supposed n to be a rational number. If, however, it were irrational, still the result would be the same; for, corresponding to every such number, two rational numbers, one greater, and the other less than it, may be found, which shall differ from each other by less than any assignable quantity. Therefore, the general properties of these numbers must belong also to the irrational number which is their limit.

the limit of $\frac{u'-u}{h} = \begin{cases} v \times \text{limit of } \frac{w'-w}{h} \\ +w \times \text{limit of } \frac{v'-v}{h}; \end{cases}$

Hence, by fubſtituting for the limiting ratios the ratios of the fluxions, we have

$$\frac{\dot{u}}{\dot{x}} = \frac{v\,\dot{w}}{\dot{x}} + \frac{w\,\dot{v}}{\dot{x}} \text{ and } \dot{u} = v\,\dot{w} + w\,\dot{v}.$$

Therefore, to find the fluxion of the product of any two functions, multiply the fluxion of each function by the other function, and the ſum of theſe products is the fluxion required.

38. We have juſt now ſeen that when

$$u = v\,w$$

$$\text{then } \dot{u} = w\,\dot{v} + v\,\dot{w}$$

Let each ſide of the latter equation be divided by the correſponding ſide of the former, thus we get

$$\frac{\dot{u}}{u} = \frac{\dot{v}}{v} + \frac{\dot{w}}{w};$$

ſuppoſe now that the function w is the product of two other functions s, t, ſo that

$$w = s\,t,$$

then, becauſe $w = s\,t$, from what has been ſhewn it follows that $\frac{\dot{w}}{w} = \frac{\dot{s}}{s} + \frac{\dot{t}}{t}$; therefore, ſubſtituting this value of $\frac{\dot{w}}{w}$ in the equation $\frac{\dot{u}}{u} = \frac{\dot{v}}{v} + \frac{\dot{w}}{w}$, it becomes

$$\frac{\dot{u}}{u} = \frac{\dot{v}}{v} + \frac{\dot{s}}{s} + \frac{\dot{t}}{t}$$

In general, if we ſuppoſe that

$$u = v\,s\,t\,r \text{ \&c.}$$

by reaſoning as above it will be found that

$$\frac{\dot{u}}{u} = \frac{\dot{v}}{v} + \frac{\dot{s}}{s} + \frac{\dot{t}}{t} + \frac{\dot{r}}{r} + \text{\&c.}$$

whatever be the number of factors.

Suppoſe the number of factors to be three, ſo that

$$u = v\,s\,t$$

$$\text{and } \frac{\dot{u}}{u} = \frac{\dot{v}}{v} + \frac{\dot{s}}{s} + \frac{\dot{t}}{t}$$

then ſubſtituting $v\,s\,t$ for u in this laſt equation, and taking away the denominators, we find

$$\dot{u} = s\,t\,\dot{v} + v\,t\,\dot{s} + v\,s\,\dot{t}.$$

And as a ſimilar reſult will be found, whatever be the number of factors, we may conclude that *The fluxion of the product of any number of functions is equal to the ſum of the products of the fluxion of each function by all the other functions.*

39. Let us in the laſt place ſuppoſe that $u = \frac{v}{w}$, and that it is required to find the fluxion of u, having given the fluxions of v and w.

From the given equation we have $v = w\,u$, and therefore (§ 37.) $\dot{v} = w\,\dot{u} + u\,\dot{w}$, let $\frac{v}{w}$ be ſubſtituted for u in this equation, and it becomes $\dot{v} = w\,\dot{u} + \frac{v\,\dot{w}}{w}$, from which we eaſily obtain

$$\dot{u} = \frac{w\,\dot{v} - v\,\dot{w}}{w^2},$$

Hence we have the following rule for finding the fluxion of a fraction.

Multiply the fluxion of the numerator by the denominator, and from the product ſubtract the fluxion of the denominator multiplied by the numerator, and divide the remainder by the ſquare of the denominator; the reſult is the fluxion required.

40. It will now be proper to ſhew the application of theſe general rules for determining the fluxions of variable functions to ſome particular examples.

Example 1. Suppoſe $u = a + b\sqrt{x} - \frac{c}{x}$. Required the fluxion of u.

Here a being a conſtant quantity, the fluxion of $a + b\sqrt{x} - \frac{c}{x}$ is the ſame as the fluxion of $b\sqrt{x} - \frac{c}{x}$, § 36, or $b\,x^{\frac{1}{2}} - c\,x^{-1}$. Now, by § 26 the fluxion of $x^{\frac{1}{2}}$ is $\frac{1}{2}x^{\frac{1}{2}-1}\,\dot{x}$, which expreſſion is equivalent to $\frac{1}{2}x^{-\frac{1}{2}}\dot{x}$, or to $\frac{\dot{x}}{2\sqrt{x}}$, and in like manner the fluxion of x^{-1} is $-x^{-1-1}\,\dot{x}$ or $-x^{-2}\,\dot{x}$, or $\frac{-\dot{x}}{x^2}$, therefore, multiplying the fluxion of $x^{\frac{1}{2}}$ by b, and the fluxion of x^{-1} by c, and taking the ſum of the products, agreeably to the rule in § 35. we have

$$\dot{u} = \frac{b\,\dot{x}}{2\sqrt{x}} + \frac{c\,\dot{x}}{x^2}$$

$$\text{or } \dot{u} = \left(\frac{b}{2\sqrt{x}} + \frac{c}{x^2}\right)\dot{x}.$$

Ex. 2. Suppoſe $u = a + \frac{b}{\sqrt[3]{x^2}} - \frac{c}{x\sqrt[3]{x}} + \frac{d}{x^2}$.

By writing the function thus

$$u = a + b\,x^{-\frac{2}{3}} - c\,x^{-\frac{4}{3}} + d\,x^{-2}$$

the application of the ſame rules employed in the laſt example gives us

$$\dot{u} = -\tfrac{2}{3}\,b\,x^{-\frac{5}{3}}\dot{x} + \tfrac{4}{3}\,c\,x^{-\frac{7}{3}}\dot{x} - 2\,d\,x^{-3}\,\dot{x}$$

or, exchanging the fractional indices for the radical ſign, and otherwiſe reducing,

$$\dot{u} = \frac{-2\,b\,\dot{x}}{3x\sqrt[3]{x^2}} + \frac{4\,c\,\dot{x}}{3x^2\sqrt[3]{x}} - \frac{2\,d\,\dot{x}}{x^3}$$

Ex. 3.

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Ex. 3. Suppose $u=(a+bx^m)^n$.

In order to find the fluxion of this function by the rules already laid down, it will be neceſſary to conſider it firſt as a function of a variable quantity that is itſelf a function of x. Let us then put $a+bx^m$ equal to v, and thus the propoſed equation becomes $u=v^n$; then, u being conſidered as a function of v, we have by § 26. $\dot{u}=nv^{n-1}\dot{v}$. Again, v being conſidered as a function of x, from the equation $v=a+bx^m$, we find by § 36, and § 26, $\dot{v}=mbx^{m-1}\dot{x}$; Let this value of $\dot{v}$ be ſubſtituted in the expreſſion for $\dot{u}$, and it becomes

$$\dot{u}=mnbv^{n-1}x^{m-1}\dot{x},$$

which, by ſubſtituting for v its value $a+bx^m$, is alſo

$$\dot{u}=mnbx^{m-1}(a+bx^m)^{n-1}\dot{x}.$$

Ex. 4. Suppoſe $u=\sqrt{(a^2-x^2)}$.

Here we are to proceed as in the laſt example, and firſt put $a^2-x^2=v$, then $u=\sqrt{v}=v^{\frac{1}{2}}$; and therefore (§ 26) $\dot{u}=\frac{1}{2}v^{\frac{1}{2}-1}\dot{v}=\frac{\dot{v}}{2v^{\frac{1}{2}}}=\frac{\dot{v}}{2\sqrt{v}}$. Again, ſince $v=a^2-x^2$, by § 26, we find $\dot{v}=-2x\dot{x}$. Subſtitute this value of $\dot{v}$ in the expreſſion for $\dot{u}$, and we have

$$\dot{u}=-\frac{2x\dot{x}}{2\sqrt{v}}$$

which, by reſtoring $\sqrt{(a^2-x^2)}$ for v, and leaving out the number common to the numerator and denominator, becomes

$$\dot{u}=\frac{-x\dot{x}}{\sqrt{(a^2-x^2)}}.$$

Ex. 5. Suppoſe $u=\sqrt{(a+bx+cx^2)}$.

By proceeding in the ſame manner as in laſt example we find

$$\dot{u}=\frac{(b+2cx)\dot{x}}{\sqrt{(a+bx+cx^2)}}.$$

Ex. 6. Suppoſe $u=x(a^2+x^2)\sqrt{(a^2-x^2)}$.

Here the propoſed function is the product of theſe three functions, viz x, a^2+x^2, and $\sqrt{(a^2-x^2)}$. Therefore, its fluxion will be found by proceeding according to the rule in § 38.

Now the fluxion of x is $\dot{x}$, and the fluxion of a^2+x^2 is $2x\dot{x}$, and the fluxion of $\sqrt{(a^2-x^2)}$ has been found in laſt example to be $\frac{-x\dot{x}}{\sqrt{(a^2-x^2)}}$. Therefore, multiplying the fluxion of each function by the product of the other two functions, and taking the ſum of all theſe products, we find

$$\dot{u}=\begin{cases}(a^2+x^2)\sqrt{a^2-x^2}\,\dot{x}\\ +2x^2\sqrt{a^2-x^2}\,\dot{x}\\ -\frac{x^2(a^2+x^2)\dot{x}}{\sqrt{(a^2-x^2)}}\end{cases}$$

and this equation, by reducing all the terms on the latter ſide of it to a common denominator, is more ſimply expreſſed thus,

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$$\dot{u}=\frac{(a^4+a^2x^2-4x^4)\dot{x}}{\sqrt{(a^2-x^2)}}.$$

Ex. 7. Suppoſe $u=\frac{a+x}{a^2+x^2}$.

Here we employ the rule given in § 39, for finding the fluxion of a fractional function; thus we find

$$\dot{u}=\frac{(a^2+x^2)\dot{x}-2x(a+x)\dot{x}}{(a^2+x^2)^2},$$

which when reduced is

$$\dot{u}=\frac{(a^2-2ax-x^2)\dot{x}}{(a^2+x^2)^2}.$$

Ex. 8. Suppoſe

$$a=\sqrt{\left\{(a-\frac{b}{\sqrt{x}}+\sqrt[3]{(c^2-x^2)^2})^3\right\}}$$

To ſimplify this expreſſion we put

$$\frac{b}{\sqrt{x}}=y,\ \sqrt[3]{(c^2-x^2)^2}=z,$$

Thus we have

$$u=\sqrt{(a-y+z)^3}=(a-y+z)^{\frac{3}{2}}$$

Now as the fluxion of $a-y+z$, is $-\dot{y}+\dot{z}$ (§ 35). we find from § 26, that by conſidering $a-y+z$ as a ſingle variable quantity,

$$\begin{aligned}\dot{u}&=\tfrac{3}{2}(a-y+z)^{\frac{3}{2}-1}(-\dot{y}+\dot{z})\\ &=\tfrac{3}{2}(a-y+z)^{\frac{1}{2}}(-\dot{y}+\dot{z})\\ &=\tfrac{3}{2}\sqrt{a-y+z}(-\dot{y}+\dot{z})\end{aligned}$$

but, ſince $y=\frac{b}{\sqrt{x}}=bx^{-\frac{1}{2}}$, we have, § 26,

$$\dot{y}=-\tfrac{1}{2}bx^{-\frac{1}{2}-1}\dot{x}=-\frac{b\dot{x}}{2x\sqrt{x}};$$

and ſince $z=\sqrt[3]{(c^2-x^2)^2}=(c^2-x^2)^{\frac{2}{3}}$, by conſidering c^2-x^2 as a ſingle variable quantity, and obſerving that its fluxion is $-2x\dot{x}$, we find by § 26, that

$$\dot{z}=\tfrac{2}{3}(c^2-x^2)^{\frac{2}{3}-1}\times-2x\dot{x}=\frac{-4x\dot{x}}{3\sqrt[3]{(c^2-x^2)}}$$

Inſtead of y, z, $\dot{y}$, $\dot{z}$, ſubſtitute now their values in the expreſſion for the fluxion of u, thus it becomes

$$\dot{u}=\tfrac{3}{2}\sqrt{(a-\frac{b}{\sqrt{x}}+\sqrt[3]{(c^2-x^2)^2})}\times\left(\frac{b\dot{x}}{2x\sqrt{x}}-\frac{4x\dot{x}}{3\sqrt[3]{(c^2-x^2)}}\right).$$

Ex. 9. Suppoſe $u=av^my^n$, where v, and y denote any functions of a variable quantity.

Then, § 37,

$$\dot{u}=\begin{cases}ay^n\times\text{ fluxion of }v^m\\ +av^m\times\text{ fluxion of }y^n\end{cases}$$

But

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But fluxion of $v^m = m v^{m-1} \dot{v}$, § 26,
and fluxion of $y^n = n y^{n-1} \dot{y}$;
therefore,

$$\dot{u} = am y^n v^{m-1} \dot{v} + an v^m y^{n-1} \dot{y},$$
$$= a v^{m-1} y^{n-1} (my \dot{v} + n v \dot{y}).$$

Ex. 10. Suppoſe $u = \frac{v+z}{y^3}$, where v, z and y denote any functions of a variable quantity. Then, becauſe fluxion $(v+z) = \dot{v} + \dot{z}$, § 34, and fluxion $y^3 = 3 y^2 \dot{y}$, § 26, we have, § 39,

$$\dot{u} = \frac{y^3(\dot{v}+\dot{z}) - 3(v+z) y^2 \dot{y}}{y^6},$$
$$= \frac{y(\dot{v}+\dot{z}) - 3(v+z)\dot{y}}{y^4}.$$

41. As when u denotes that particular function of x which is x^n, we have (§ 25.)

$$\frac{\dot{u}}{\dot{x}} = n x^{n-1};$$

ſo in general, whatever be the form of the function denoted by u, we have always

$$\frac{\dot{u}}{\dot{x}} = p,$$

where p denotes a new function of x, reſulting from the analytical proceſs employed to find the fluxion of the function u, and depending for its form upon the particular form of that function: juſt as in involution, or any of the other operations of algebra, a reſult is obtained depending upon the particular nature of the operation, and the quantities operated upon.

Let us put p to denote the particular function $n x^{n-1}$, or the expreſſion for $\frac{\dot{u}}{\dot{x}}$ the ratio of the fluxion of u to the fluxion of x when $u = x^n$, then, ſuppoſing that $n-1$ is not equal to 0, (for in that caſe $n x^{n-1}$ would be ſimply n, a given number,) we may reaſon concerning the ratio of the fluxions of the variable quantities p and x, in all reſpects as concerning the ratio of the fluxions of u and x; and accordingly, from the equation

$$p = n x^{n-1},$$

we get, by taking the fluxions,

$$\frac{\dot{p}}{\dot{x}} = n(n-1) x^{n-2},$$

or, conſidering p as denoting generally the function of x that reſults from the operation of finding the fluxion of the original function u, whatever be the form of that function, we have

$$\frac{\dot{p}}{\dot{x}} = q,$$

where q denotes a new function of x, derived from p, the former function, by the ſame kind of operation as that by which p was deduced from u. Direct Method.

Suppoſe now q to denote the particular function $n(n-1) x^{n-2}$, then,

$$\frac{\dot{q}}{\dot{x}} = n(n-1)(n-2) x^{n-3},$$

or $\frac{\dot{q}}{\dot{x}} = r,$

where r denotes a function of x derived from q, as q was derived from p, or p from the original function u. And it is evident that we may proceed in this manner as far as we pleaſe, unleſs it happen that in finding the ſeries of functions $p, q, r,$ &c. we at laſt arrive at a reſult that is a conſtant quantity, and then the ſeries of operations will terminate. Thus if the function was $a x^4$, we ſhould have

$$u = a x^4,$$
$$\frac{\dot{u}}{\dot{x}} = 4 a x^3 = p,$$
$$\frac{\dot{p}}{\dot{x}} = 4.3 a x^2 = q,$$
$$\frac{\dot{q}}{\dot{x}} = 4.3.2 a x = r,$$
$$\frac{\dot{r}}{\dot{x}} = 4.3.2.1.a = 2 4 a$$

Here the expreſſion for $\frac{\dot{r}}{\dot{x}}$ is a conſtant quantity, which has no fluxion.

Hence it appears, that relatively to any function of a variable quantity, there exiſts a ſeries of limiting ratios, deducible from that function, and from each other, by a repetition of the operation of finding the fluxion of a variable function.

42. In treating of the fluxion of a function, we have hitherto regarded the fluxion of the variable quantity x, from which the function is formed, merely as one of the terms of a ratio, without conſidering whether it was a conſtant or a variable quantity.

Now as we may aſſume any hypotheſis reſpecting the nature of the fluxion of x, that is not inconſiſtent with what has been already delivered, we ſhall ſuppoſe it to be conſtant. This aſſumption, if we conſider the fluxions of variable quantities as the meaſures of their reſpective velocities, or rates of increaſe, is in effect the ſame thing as to ſuppoſe that the variable quantity x increaſes uniformly. Then, as in the expreſſions

$$\frac{\dot{u}}{\dot{x}} = p, \quad \frac{\dot{p}}{\dot{x}} = q, \quad \frac{\dot{q}}{\dot{x}} = r, \text{ &c.}$$

or theſe others, which follow from them,

$$\dot{u} = p\dot{x}, \quad \dot{p} = q\dot{x}, \quad \dot{q} = r\dot{x}, \text{ &c.}$$

the ſymbol $\dot{x}$ is to be underſtood as denoting a conſtant quantity, it follows that if p be variable, then $p\dot{x}$, or $\dot{u}$ will be variable; and if q be variable, then $q\dot{x}$, or

$\dot{p}$ will

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$\dot{p}$, will be variable; and if r be variable, then $r\dot{x}$, or $\dot{q}$ will be variable and so on.

43. Let us now recur to the relation in which the succeeding functions p, q, r, &c. stand to the original function u.

By performing that particular analytical operation upon the function u, which consists in finding its fluxion, we obtain $p\dot{x}$ as the expression for its fluxion, that is, we get $\dot{u}=p\dot{x}$; and by repeating the operation on the function p, we get $\dot{p}=q\dot{x}$; and therefore $\dot{p}\,\dot{x}=q\dot{x}^2$; but, $\dot{x}$ being regarded as a constant quantity, $\dot{p}\,\dot{x}$ is deduced from $p\dot{x}$, considered as a function of x, just in the same manner as $p\dot{x}$ is derived from the original function u; therefore the expression $q\dot{x}^2$ is deduced from the function u by performing the operation of taking the fluxion twice; that is, first upon the function u itself, and then upon $\dot{u}$, or $p\dot{x}$, the expression for its fluxion; and in this second operation $\dot{x}$ (or the fluxion of the quantity from which the function is formed) is considered as a constant quantity.

The expression $q\dot{x}^2$, obtained in this manner from the function u, is called the *second fluxion* of the function; and to express its relation to the function u, it is denoted by $\ddot{u}$, that is, by the letter denoting the function itself with two dots over it. Thus, like as $\dot{u}=p\dot{x}$, we have

$$\ddot{u}=q\dot{x}^2, \text{ and } \frac{\ddot{u}}{\dot{x}^2}=q.$$

Again, since $\dot{q}=r\dot{x}$, it follows that $\dot{q}\,\dot{x}^2=r\dot{x}^3$; but, as $\dot{x}$ is constant, $\dot{q}\,\dot{x}^2$ is derived from $q\dot{x}^2$, by the operation of finding its fluxion, considering it as a function of x, just in the same manner as $q\dot{x}^2$, or $\ddot{u}$ is derived from $p\dot{x}$, or $\dot{u}$, and in the same manner as $\dot{u}$ is derived from the original function u; therefore, like as $p\dot{x}$ or $\dot{u}$ is the first fluxion of the function, and $q\dot{x}^2$ or $\ddot{u}$ is its second fluxion, so $r\dot{x}^3$ is called its *third fluxion*, and is denoted by $\dddot{u}$, that is by the letter expressing the function itself, having three dots placed over it, so that

$$\dddot{u}=r\dot{x}^3 \text{ and } \frac{\dddot{u}}{\dot{x}^3}=r.$$

The fourth fluxion of a variable function u is denoted by $\ddddot{u}$, that is by the letter u with four dots over it, and is derived from the third fluxion, in the same manner as the third is derived from the second, or the second from the first, or the first fluxion from the variable function itself; observing, that in repeating the operation of taking the fluxions, the symbol $\dot{x}$ (or the fluxion of the variable quantity from which the function is formed) is considered as a constant quantity. And the same mode of notation and deduction is to be understood as applying to a fluxion of any order whatever of a variable function.

44. To illustrate what has been said respecting the second and higher orders of fluxions of a function, let us suppose u to denote the particular function $a\,x^n$; then, proceeding agreeably to what has been laid down in last section, we obtain, by the rule for finding the fluxion of any power of a variable quantity (§ 26)

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$$\dot{u}=n\,a\,x^{n-1}\dot{x},$$
$$\ddot{u}=n\,(n-1)\,a\,x^{n-2}\dot{x}^2,$$
$$\dddot{u}=n\,(n-1)\,(n-2)\,a\,x^{n-3}\dot{x}^3,$$
$$\ddddot{u}=n\,(n-1)\,(n-2)\,(n-3)\,a\,x^{n-4}\dot{x}^4, \text{ \&c.}$$

Here we have exhibited the first, second, third, and fourth fluxions of the function $a\,x^n$; the law of continuation is obvious, and it appears that when n is any positive integer, the function $a\,x^n$ will have as many orders of fluxions, as there are units in n, and no more; for if n were supposed $=3$, then, as the fourth fluxion, and all the subsequent ones, are multiplied by $n-3$, or in that case by $3-3=0$, they consequently would vanish, and a similar observation may be made when n is any other whole positive number.

45. That we might be able to apply the rules of § 26, § 34, &c. to the determination of the fluxion of a complex function of a variable quantity, we have found it convenient in some cases to consider such a function as composed of other more simple functions of the same quantity, and we have expressed its fluxion by means of the fluxions of those other functions. In finding the fluxion of any higher order than the first of such a complex function by those rules, we must keep in mind, that it is only the fluxion of x, the variable quantity from which the functions are all formed, that is to be considered as constant, and that the fluxions of the functions themselves are in general variable quantities; so that each of them may have a second, third, &c. fluxion, as well as the function which is composed of them.

Let us suppose for example, that

$$u=\sqrt{(a^2+x^2)};$$

then, considering a^2+x^2 as a function of x, and putting v to denote it, we have $u=\sqrt{v}=v^{\frac{1}{2}}$, and $\dot{u}=\frac{1}{2}v^{-\frac{1}{2}}\dot{v}=\frac{\frac{1}{2}\dot{v}}{\sqrt{v}}$; but since $v=a^2+x^2$, it follows that $\dot{v}=2x\dot{x}$; therefore, substituting for v and $\dot{v}$ their respective values, we have

$$\dot{u}=\frac{x\,\dot{x}}{\sqrt{(a^2+x^2)}}.$$

Now, to find the second fluxion of u, we may either take the fluxion of this last expression, viz. $\frac{x\,\dot{x}}{\sqrt{(a^2+x^2)}}$, and consider the symbol $\dot{x}$, which is found in it, as denoting a constant quantity; or we may recur to the equation $\dot{u}=\frac{\frac{1}{2}\dot{v}}{\sqrt{v}}$, and take the fluxion of this other expression for $\dot{u}$; and in this case, we must consider that both v and $\dot{v}$ denote variable functions of x, and therefore that the fluxion of $\frac{\frac{1}{2}\dot{v}}{\sqrt{v}}$ may be found by the rule

for

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for finding the fluxion of a function; obſerving that $\ddot{v}$ is to be ſubſtituted as the fluxion of $\dot{v}$. Accordingly, proceeding by this laſt method, and conſidering that the fluxion of $\sqrt{v}$ the denominator of the fraction is $\frac{\frac{1}{2}\dot{v}}{\sqrt{v}}$, we find

$$\dot{u}\begin{cases}=\dfrac{\frac{1}{2}\sqrt{v}\,\ddot{v}-\frac{\frac{1}{4}\dot{v}\dot{v}}{\sqrt{v}}}{v},\\ =\dfrac{2v\ddot{v}-\dot{v}^2}{4v\sqrt{v}}.\end{cases}$$

Now from the equation $v=a^2+x^2$, we have $\dot{v}=2x\dot{x}$, and (obſerving that $\dot{x}$ is conſtant) $\ddot{v}=2\dot{x}^2$. Let theſe values of v, $\dot{v}$, and $\ddot{v}$, be now ſubſtituted in the expreſſion for $\dot{u}$, and it becomes

$$\ddot{u}\begin{cases}=\dfrac{4(a^2+x^2)\dot{x}^2-4x^2\dot{x}^2}{4(a^2+x^2)\sqrt{(a^2+x^2)}},\\ =\dfrac{a^2\dot{x}^2}{(a^2+x^2)^{\frac{3}{2}}},\end{cases}$$

The very ſame expreſſion for $\ddot{u}$ would have been found if we had employed the other method.

By proceeding as in this laſt example, the rules already delivered for finding the firſt fluxion of any function of a variable quantity will apply to the finding of the fluxion of any higher order.

Thus if we had $u=vt$, where v and t denote each a function of another variable quantity x, and it were required to find the different orders of fluxions of u, conſidered alſo as a function of x; then, by the rule of § 37, we have

$$\dot{u}=t\dot{v}+v\dot{t},$$

and $\ddot{u}=$ fluxion of $t\dot{v}$ + fluxion of $v\dot{t}$;

but v and t being variable functions of x, we may conſider $\dot{v}$ and $\dot{t}$ as denoting alſo variable functions of x, the the fluxions of which are to be denoted by $\ddot{v}$ and $\ddot{t}$ reſpectively; now by the rule in § 37, we have

$$\text{fluxion of } t\dot{v}=\dot{v}\dot{t}+t\ddot{v},$$

$$\text{and fluxion of } v\dot{t}=\dot{t}\dot{v}+v\ddot{t},$$

$$\text{therefore, } \ddot{u}=2\dot{v}\dot{t}+t\ddot{v}+v\ddot{t}.$$

By conſidering v, $\dot{v}$, $\ddot{v}$, alſo t, $\dot{t}$, $\ddot{t}$, as denoting each a diſtinct function of x, we may find the third fluxion of u from the ſecond, in the ſame manner as the ſecond has been found from the firſt, and ſo on for the other orders of fluxions of u. If it be now required to expreſs the ſucceſſive orders of fluxions of u in terms of x and its fluxion, we muſt find the values of $\dot{v}$, $\ddot{v}$, &c. alſo of $\dot{t}$, $\ddot{t}$ &c. in terms of x and its fluxion, and theſe values, alſo the particular functions of x denoted by v and t, being ſubſtituted in the expreſſions found for $\dot{u}$, $\ddot{u}$, &c. will give to theſe expreſſions the form required.

If for example we ſuppoſe that

$$v=a+bx^m, \qquad t=c+dx^n,$$

$$\text{then } \dot{v}=mbx^{m-1}\dot{x} \qquad \dot{t}=ndx^{n-1}\dot{x}$$

and, conſidering $\dot{x}$ as conſtant,

$$\ddot{v}=m(m-1)bx^{m-2}\dot{x}^2, \qquad \ddot{t}=n(n-1)dx^{n-2}\dot{x}^2$$

&c.

theſe values of v, t, $\dot{v}$, $\dot{t}$, &c. being ſubſtituted in the expreſſions of $\dot{u}$, $\ddot{u}$, &c. will give the ſucceſſive fluxions of u in terms of x and $\dot{x}$ only.

46. If the fluxion of a variable quantity be conſidered as the meaſure of its rate of increaſe, if that rate be uniform, then its meaſure will be a conſtant quantity; but if it be variable, then its meaſure will be a variable quantity, which will alſo have a certain rate of increaſe or decreaſe; and the meaſure of this rate will be its fluxion, or will be the fluxion of the fluxion of the original variable quantity; that is, it will be the ſecond fluxion of the original variable quantity. And if this ſecond fluxion is not a conſtant quantity, then the meaſure of its rate of variation will be its fluxion, or will be the third fluxion of the original variable quantity, and ſo on. Thus a quantity will have a ſucceſſive order of fluxions till ſome one fluxion become conſtant, and then it will have no more.

47. We have hitherto ſuppoſed the equation expreſſing the relation between a variable quantity, and a function of that quantity, to be of ſuch a form, that the function was found alone, and of the firſt degree on one ſide of the equation, and ſome power, or combination of powers, of the variable quantity on the other; as in theſe examples,

$$u=ax^n, \qquad u=\frac{a+bx^m}{c+dx^n}.$$

In ſuch caſes as theſe, u is ſaid to be an *explicit* function of x. We are now to conſider how the ratio of the fluxions is to be found when the relation between the variable quantity and its function is expreſſed by an equation, the terms of which involve different powers, both of the function, and the variable quantity; as in the following example,

$$y^2-axy+bx^2-c=0,$$

where we are to conſider y as a function of x; but from the particular manner in which its relation to x is expreſſed, it is ſaid to be an *implicit* function of that quantity.

Now in this example, by the reſolution of a quadratic equation, we find

$$y=\frac{ax\pm\sqrt{\{(a^2-4b)x^2+4c\}}}{2},$$

and as y is here an *explicit* function of x, its fluxion, or the ratio of its fluxion to that of x, might be determined by the rules already laid down. But it is to be obſerved that it is only in the particular caſe of the propoſed equation being of the ſecond degree that we can effect the ſolution generally in this manner. If it

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were of a higher order, this particular mode of folution would be often impracticable, for want of a general method of refolving equations.

48. We may however in all cafes refolve the problem, without a previous refolution of the equation, by reafoning as follows.

Whatever be the degree of the equation, by giving particular values to x, we can, by the theory of equations, obtain correfponding particular values of y; therefore, we may be affured that in every cafe y is expreffible by means of x in fome way or other, if not in finite terms, at leaft in the form of a feries, the terms of which fhall involve powers of x. Hence we may infer, as in the cafe of *explicit* functions, that when x changes its value, and becomes $x+h$, y will alfo change its value, and become

$$y+p\,h+q\,h^2+\&c.$$

where p, q, &c. denote functions of x, that are independent of the arbitrary quantity h. Let us denote $p\,h+q\,h^2+$ &c. the increment of y, by the fingle letter k; then $y+k$ is the new value of y, correfponding to $x+h$, the new value of x. Let thefe new values be fubftituted inftead of x and y in the propofed equation

$$y^2-a\,x\,y+b\,x^2-c=0,$$

and as the refult muft ftill be $=0$, we have

$$(y+k)^2-a(x+h)(y+k)+b(x+h)^2-c=0;$$

which equation, by actually involving its terms, fubftituting for k its value $p\,h+q\,h^2+$&c. and arranging the refult in the form of a feries proceeding by the powers of h, becomes

$$\left.\begin{array}{c} y^2-a\,x\,y+b\,x^2-c \\ (2\,p\,y-a(p\,x+y)+2\,b\,x)h \\ +\mathrm{Q}\,h^2+\mathrm{R}\,h^3+\&c. \end{array}\right\}=0$$

Here Q, R, &c. denote quantities independent of h, and involving x, y, p, q, &c. that is to fay, x, and functions of x, and therefore Q, R, &c. are alfo functions of x. Now as this equation muft fubfift whatever h may be, which is a quantity quite arbitrary and independent of the coefficients by which its powers are multiplied; it follows (as has been obferved when treating of the method of indeterminate coefficients, ALGEBRA, § 261.) that the coefficients of the different powers of h muft be each equal to 0.

Therefore,

$$\begin{array}{c} y^2-a\,x\,y+b\,x^2-c=0 \\ 2\,p\,y-a(p\,x+y)+2\,b\,x=0, \\ \&c. \end{array}$$

From the firft of thefe equations we can infer nothing, as it is no other than the propofed equation itfelf; but from the fecond we find

$$p=\frac{a\,y-2\,b\,x}{2\,y-a\,x}.$$

Now h, and $k=ph+q\,h^2+$ &c. being the fimultaneous increments of x and y, we have $\frac{k}{h}=p+q\,h+$ &c. therefore, fuppofing h to be continually diminifhed, and putting $\frac{\dot{y}}{\dot{x}}$ equal to the limit of $\frac{k}{h}$, we have $\frac{\dot{y}}{\dot{x}}=p$, therefore

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$$\frac{\dot{y}}{\dot{x}}=\frac{a\,y-2\,b\,x}{2\,y-a\,x};$$

thus we have obtained an expreffion for the ratio of the fluxions of y and x, from which we find

$$2\,y\,\dot{y}-a\,(x\,\dot{y}+y\,\dot{x})+2\,b\,x\,\dot{x}=0,$$

and this is precifely the expreffion we fhould have obtained, had we taken the fluxion of each term of

$$y^2-a\,x\,y+b\,x^2-c=0,$$

the propofed equation, and put the refult equal to 0.

49. But to fee that this will always be the cafe, whatever be the degree of the equation, we have only to obferve, that, by the very fame procefs employed to deduce from the original equation

$$y^2-a\,x\,y+b\,x^2-c=0,$$

thefe two others

$$2\,y\,p-a\,(x\,p+y)+2\,b\,x=0,$$

$$2\,y\,\dot{y}-a\,(x\,\dot{y}+y\,\dot{x})+2\,b\,x\,\dot{x}=0;$$

if we fuppofe the equation to be generally expreffed thus,

$$y^l+a\,y^m x^n\cdots+x^r+c=0,$$

where the exponents l, m, n, &c. r denote conftant quantities, we fhall obtain

$$\left.\begin{array}{c} l\,y^{l-1}p+a\,(m\,y^{m-1}x^n\,p+n\,y^m x^{n-1}) \\ \cdots+r\,x^{r-1} \end{array}\right\}=0,$$

and hence, by fubftituting for p its value $\frac{\dot{y}}{\dot{x}}$, and bringing $\dot{x}$ from the denominator,

$$\left.\begin{array}{c} l\,y^{l-1}\dot{y}+a\,(m\,y^{m-1}x^n\dot{y}+n\,y^m\,x^{n-1}\dot{x}) \\ \cdots+r\,x^{r-1}\dot{x} \end{array}\right\}=0.$$

From which it appears that, when the relation between x, a variable quantity, and y, a function of that quantity, is expreffed by an equation, the terms of which are brought all to one fide, fo as to produce an expreffion $=0$; *the relation of the fluxions will be found, by taking the fluxion of each term of the equation (conffidering* y *as a function of* x*), and putting the fum of thefe fluxions equal to* 0.

50. Having from the equation

$$y^2-a\,x\,y+b\,x^2-c=0.$$

found that

$$\dot{y}=\frac{(a\,y-2\,b\,x)\,\dot{x}}{2\,y-a\,x},$$

if it be required to find the fecond fluxion of y, we have only to take the fluxion of the latter fide of this equation,

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equation, conſidering $\dot{x}$ as conſtant, and y as a function of x; thus we have

$$\ddot{y}=\frac{\left\{\begin{array}{l}(2y-ax)(a\dot{y}-2b\dot{x})\dot{x}\\ -(ay-2bx)(2\dot{y}-a\dot{x})\dot{x}\end{array}\right\}}{(2y-ax)^2}$$

an equation which abbreviates to

$$\ddot{y}=\frac{(4t-a^2)(x\dot{y}-y\dot{x})\dot{x}}{(2y-ax)^2},$$

and from which we may exterminate $\dot{y}$ by means of the equation

$$\dot{y}=\frac{(ay-2bx)\dot{x}}{2y-ax}.$$

By the ſame mode of proceeding we may determine the third, or any higher fluxion of the function y.

51. As far as we have yet gone in explaining the principles of fluxions, we have had continually occaſion to employ the rule for finding the fluxion of the particular function x^n, where x denotes a variable quantity, and n any conſtant number; and we may therefore, in reſpect of other functions conſider x^n as a ſimple function. Beſides the function x^n, writers on Analyſis have conſidered each of the following as alſo conſtituting a ſimple analytic function of a variable quantity; viz.

a^x, where a is conſtant, and x is variable.

Log. x, that is the logarithm of x, a variable number.

Sin. x, that is the ſine of x, a variable arch of a circle, radius being unity.

Cof. x, that is the coſine of x, a variable arch of a circle, radius being as before unity.

52. We have already found the fluxion of x^n, and we proceed to find the fluxions of the other ſimple functions of x; and, as in the inveſtigation of theſe we ſhall have occaſion to employ the binomial theorem, it will be proper to ſhow how that theorem may be deduced from the principles already explained. We are then to find the ſeries that expreſſes $(a+x)^n$, when n is any number whatever. Or, ſince $(a+x)^n$ is equal to $a^n(1+v)^n$, where v denotes the fraction $\frac{x}{a}$, we may leave the quantity a^n out of conſideration, as has been formerly obſerved, § 28, and ſeek the ſeries that expreſſes $(1+v)^n$. As we have already pointed out (§ 28) the proceſs of induction by which we may find the general form of the ſeries, we ſhall not here repeat it, but aſſume

$$(1+v)^n=1+Av+Bv^2+Cv^3+Dv^4+\&c.$$

where A, B, C, D, &c. denote numbers that are independent of v.

Now, as the fluxion of a variable function muſt be the ſame, whether that function be expreſſed by one term, or developed into a ſeries of terms; by performing the operation of taking the fluxion on each ſide of the above equation, the reſults muſt be equal, that is, § 26.

$$n(1+v)^{n-1}\dot{v}=A\dot{v}+2Bv\dot{v}+3Cv^2\dot{v}+4Dv^3\dot{v}+\&c.$$

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or, leaving out the quantity $\dot{v}$, common to each term,

$$n(1+v)^{n-1}=A+2Bv+3Cv^2+4Dv^3+\&c.$$

Let both ſides of this equation be multiplied by $1+v$, and divided by n, thus we ſhall have

$$(1+v)^n=\frac{1}{n}\left\{\begin{array}{l}A+2Bv+3Cv^2+4Dv^3+\&c.\\ +Av+2Bv^2+3Cv^3+\&c.\end{array}\right\}$$

Thus, by performing on the quantities the analytical proceſs of taking their fluxions, we have obtained a new expreſſion for $(1+v)^n$. Let the quantities that are independent of v in each expreſſion be put equal to each other, and alſo the co-efficients of like powers of v; thus we obtain

$$1=\frac{A}{n}, \text{ and hence } A=n$$

$$A=\frac{A+2B}{n},\quad B=\frac{n-1}{2}A$$

$$B=\frac{2B+3C}{n},\quad C=\frac{n-2}{3}B$$

$$C=\frac{3C+4D}{n},\quad D=\frac{n-3}{4}C$$

&c. &c.

Or, ſubſtituting ſucceſſively the expreſſion for each coefficient in that which follows it,

$$A=n,$$

$$B=\frac{n(n-1)}{2},$$

$$C=\frac{n(n-1)(n-2)}{2\cdot 3},$$

$$D=\frac{n(n-1)(n-2)(n-3)}{2\cdot 3\cdot 4},$$

&c.

Hence it appears that

$$(1+v)^n=1+nv+\frac{n(n-1)}{2}v^2+\frac{n(n-1)(n-2)}{2\cdot 3}v^3+\frac{n(n-1)(n-2)(n-3)}{2\cdot 3\cdot 4}v^4+\&c.$$

and therefore, ſubſtituting $=\frac{x}{a}$ for v, and multiplying by a^n,

$$(a+x)^n=a^n+na^{n-1}x+\frac{n(n-1)}{2}a^{n-2}x^2+\frac{n(n-1)(n-2)}{2\cdot 3}a^{n-3}x^3+\&c.$$

where the law of continuation is evident.

53. We now proceed to inveſtigate the fluxion of the function $u=a^x$, a being ſuppoſed conſtant, and x the variable quantity, to which the function is referred.

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Let x be ſuppoſed, as formerly, to change its value, and to become $x+h$, and put u' for the new value that the function acquires by this change in the magnitude of x, then we have

$$u'=a^{x+h}=a^x \times a^h,$$

and, taking the difference between the two ſucceeding values,

$$u'-u=a^x \times a^h - a^x = a^x (a^h-1).$$

We muſt now develope the expreſſion a^h-1 into a ſeries, the terms of which are arranged according to the ſucceſſive powers of the increment h. To effect this, let us put $b=a-1$, ſo that $a=1+b$, and $a^h=(1+b)^h$; but by the binomial theorem, this laſt expreſſion may be expanded into the following ſeries:

$$1+hb+\frac{h(h-1)}{2}b^2+\frac{h(h-1)(h-2)}{2\cdot 3}b^3+ \&c.$$

Therefore,

$$a^h=1+hb+\frac{h(h-1)}{2}b^2+\frac{h(h-1)(h-2)}{2\cdot 3}b^3+ \&c.$$

As the terms of this ſeries are not arranged according to the powers of h, but according to the powers of b, it is neceſſary that we tranſform it into another having the required form; now this may be effected by actually multiplying together all the factors that conſtitute each term, and arranging the ſeries anew in ſuch a manner, that each of its terms may be a power of h, multiplied by a coefficient compoſed only of the powers of b, and given numbers;

Accordingly we have

$$\begin{aligned} hb \quad . \quad . \quad . &= bh, \\ \frac{h(h-1)}{2}b^2 &= -\frac{b^2}{2}h+\frac{b^2}{2}h^2, \\ \frac{h(h-1)(h-2)}{2\cdot 3}b^3 &= \frac{b^3}{3}h-\frac{b^3}{2}h^2+\frac{b^3}{6}h^3, \\ \&c. & \end{aligned}$$

Therefore, by taking the ſum of all the quantities on each ſide of theſe equations, we get the ſeries,

$$1+hb+\frac{h(h-1)}{2}b^2+\frac{h(h-1)(h-2)}{2\cdot 3}b^3+ \&c.$$

otherwiſe expreſſed thus,

$$1+A\,h+B\,h^2+C\,h^3+ \&c.$$

where A is equal to the infinite ſeries $b-\frac{b^2}{2}+\frac{b^3}{3}-\frac{b^4}{4}+ \&c.$

that is, to

$$\frac{a-1}{1}-\frac{(a-1)^2}{2}+\frac{(a-1)^3}{3}-\frac{(a-1)^4}{4}+ \&c.$$

and B, C, &c. are alſo quantities compoſed of the powers of b, and conſequently are independent of h; but as theſe are all to diſappear in the courſe of the inveſtigation, it is not neceſſary to expreſs them otherwiſe, than by a general ſymbol. Therefore, we have now got

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$$a^h=1+A\,h+B\,h^2+C\,h^3+ \&c.$$

and conſequently,

$$u'-u=a^x(a^h-1)=a^x(A\,h+B\,h^2+C\,h^3+ \&c.)$$

and

$$\frac{u'-u}{h}=A\,a^x+B\,a^x h+C\,a^x h^2+ \&c.$$

Hence, when h is conceived to be continually diminiſhed, we have the limit of $\frac{u'-u}{h}$, expreſſed by Aa^x, and therefore § 21,

$$\frac{\dot{u}}{\dot{x}}=Aa^x, \text{ and } \dot{u}=A\,a^x\dot{x}.$$

54. In the preceding inveſtigation, we have had occaſion to develope the exponential expreſſion a^h into a ſeries of this form,

$$1+A\,h+B\,h^2+C\,h^3+ \&c.$$

that is, a ſeries the terms of which are the ſucceſſive powers of the exponent, each multiplied by a coefficient, which is independent of the exponent.

We have however only determined the coefficients of the firſt two terms of the ſeries, theſe being the only ones we had occaſion to employ.

The reſult of the inveſtigation however may be applied to determine all the coefficients by the very ſame kind of proceſs as that which we have employed in § 53, to determine the coefficients of the terms of the ſeries which conſtitutes the other expanſion of a^h.

Inſtead of denoting the exponent by h, let us conſider it as a variable quantity, and expreſs it by x, then, from what has been ſhewn it appears that

$$a^x=1+A\,x+B\,x^2+C\,x^3+D\,x^4+ \&c.$$

where A, B, C, &c. expreſs conſtant quantities. Let the operation of taking the fluxions be now performed on both ſides of this equation, (obſerving that the fluxion of a^x is $A\,a^x\,\dot{x}$) and let all the terms be divided by $\dot{x}$, which is common to each, thus we obtain

$$A\,a^x=A+2B\,x+3C\,x^2+4D\,x^3+ \&c.$$

and, dividing by A,

$$a^x=1+2\frac{B}{A}x+\frac{3C}{A}x^2+\frac{4D}{A}x^3+ \&c.$$

Let the coefficients of the ſame powers of x in each of the two ſeries expreſſing a^x be put equal to each other, then,

$$\begin{aligned} \frac{2B}{A}&=A, \text{ hence, } B=\frac{A^2}{2}, \\ \frac{3C}{A}&=B, \quad . \quad . \quad . \quad C=\frac{A^3}{2\cdot 3}, \\ \frac{4D}{A}&=C, \quad . \quad . \quad . \quad . \quad D=\frac{A^4}{2\cdot 3\cdot 4}, \\ \&c. & \qquad\qquad \&c. \end{aligned}$$

Therefore,

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Therefore, fubſtituting theſe values of B, C, D, &c. in the original ſeries, we have

$$a^x = 1 + A x + \frac{A^2 x^2}{2} + \frac{A^3 x^3}{2.3} + \frac{A^4 x^4}{2.3.4} + \text{&c.}$$

the ſame reſult as has been found in the article ALGEBRA, § 293. by proceeding in a different manner.

55. If we ſuppoſe $x=1$, then the preceding equation becomes

$$a = 1 + A + \frac{A^2}{2} + \frac{A^3}{2.3} + \frac{A^4}{2.3.4} + \text{&c.}$$

and if we ſuppoſe $x=\frac{1}{A}$, it becomes

$$a^{\frac{1}{A}} = 1 + 1 + \frac{1}{2} + \frac{1}{2.3} + \frac{1}{2.3.4} + \text{&c.}$$

thus the quantity $a^{\frac{1}{A}}$ is equal to a conſtant number which is the value of a when $A=1$, and which, by taking the ſum of the firſt ten terms of the ſeries, is found to be 2·7182818, or, by taking the ſum of a greater number of terms, more accurately

2·71828182845904....

We ſhall, in the remainder of this treatiſe, denote this number always by e, then $a^{\frac{1}{A}}=e$, and $a=e^A$, and taking the logarithms, log. $a=A\times$log. e, hence

$$A=\frac{\log. a}{\log. e}.$$

56. If we now ſubſtitute this value of A in the expreſſion for the fluxion of $u=a^x$, found in § 53, it becomes

$$\dot{u}=\frac{\log. a}{\log. e} a^x \dot{x}.$$

Hence it appears, that the fluxion of the function a^x *is equal to the fluxion of* x *multiplied by the function itſelf, and by the quotient ariſing from the diviſion of the logarithm of* a *by the logarithm of* e, *where* e *denotes* $1+\frac{1}{1}+\frac{1}{1.2}+\frac{1}{1.2.3}+\frac{1}{1.2.3.4}+$ &c. *a ſeries whoſe ſum is* 2·7182818 *nearly.*

57. Let us now conſider the third ſimple function of x, namely $u=$log. x. Let a be the radical number of the particular ſyſtem, in which u is a logarithm, and x the correſponding number; then from the nature of logarithms (ſee ALGEBRA, § 277.) we have $a^u=x$. Now, whether we conſider u as a function of x, or x as a function of u, the limiting ratio of their ſimultaneous increments, and conſequently the ratio of their fluxions will be the very ſame. But by conſidering x as a function of u, we have immediately, from what has been ſhewn in § 53, and § 55,

$$\frac{\dot{x}}{x}=A\dot{u}=A\dot{x},$$

and therefore, $\dot{u}=\frac{1}{A}\frac{\dot{x}}{x}=\frac{\log. e}{\log. a}\frac{\dot{x}}{x}$, but as a is the radical number of the ſyſtem, log. $a=1$, therefore

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$$\dot{u}=\log. e \frac{\dot{x}}{x}.$$

The number which we have denoted by e occurs very often in analytical inveſtigations; it is the radical number of the ſyſtem of logarithms firſt invented by *Baron Napier*, and called by ſome writers *Hyperbolic* logarithms, but by others, with more propriety, *Napierean* logarithms. The expreſſion $\frac{\log. e}{\log. a}$ is called the *modulus* of the ſyſtem of logarithms whoſe radical number is a. In the Napierean ſyſtem $\frac{\log. e}{\log. a}=\frac{\log. e}{\log. e}=1$, that is, the *modulus* is unity; but in the common ſyſtem, or that in which $a=10$, the *modulus* $\frac{\log. e}{\log. a}=0{\cdot}434294482$. The rule for finding the fluxion of the logarithm of a variable quantity may now be expreſſed thus:

Multiply the fluxion of the variable quantity by the modulus of the ſyſtem, and divide the product by the variable quantity itſelf, the reſult is the fluxion required.

58. By the application of the rule for finding the fluxion of the logarithm of a variable quantity we may readily find the fluxions of exponential functions in general. Thus, for example, if $u=z^y$, z and y being both functions of any variable quantity x, then log. $u=y\times$log. z; and taking the fluxions (conſidering $y\times$log. z as the product of two functions y and log. z, and proceeding by the rules of § 37 and laſt),

$$\frac{\dot{u}}{u}=\dot{y}\log. z+y\frac{\dot{z}}{z},$$

and hence

$$\dot{u}=u\left(\dot{y}\log. z+y\frac{\dot{z}}{z}\right),$$

$$=z^y\left(\dot{y}\log. z+\frac{y\dot{z}}{z}\right).$$

59. We are next to conſider the functions $u=$ſin. x, and $u=$coſ. x.

Suppoſe x to change its value, and to become $x+h$, and u to become u', then, ſince

$$u=\text{ſin. } x, \text{ and } u'=\text{ſin. } (x+h),$$

$$u'-u=\text{ſin. } (x+h)-\text{ſin. } x;$$

but by the arithmetic of ſines (ſee ALGEBRA, § 353), ſin. $(x+h)=$ſin. x coſ. $h+$coſ. x ſin. h, therefore,

$$u'-u=\text{coſ. } x \text{ coſ. } h+\text{coſ. } x \text{ ſin. } h-\text{ſin. } x$$

$$=\text{coſ. } x \text{ ſin. } h-\text{ſin. } x\ (1-\text{coſ. } h).$$

In this caſe, as when treating formerly of other functions, we might conſider the above expreſſion for $u'-u$, as reſolvable into a ſeries $p h+q h^2+$ &c. proceeding by the powers of the increment, and thence we might

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might find the limit of $\frac{u'-u}{h}$ as before. But we may discover the limit otherwiſe, by proceeding as follows; Becauſe

$$\text{Sin.}^2 h = 1 - \text{cof.}^2 h = (1 + \text{cof. } h)(1 - \text{cof. } h)$$

$$\text{therefore, } 1 - \text{cof. } h = \frac{\text{ſin.}^2 h}{1 + \text{cof. } h};$$

Let this value of $1 - \text{cof. } h$ be ſubſtituted in the expreſſion for $u'-u$, and it becomes

$$u'-u = \text{cof. } x \text{ ſin. } h - \frac{\text{ſin. } x \text{ ſin.}^2 h}{1 + \text{cof. } h};$$

And hence, dividing by h, and arranging the terms ſo as to exhibit the ratio $\frac{\text{ſin. } h}{h}$, we get

$$\frac{u'-u}{h} = \frac{\text{ſin. } h}{h}\left\{\text{cof. } x - \frac{\text{ſin. } h \text{ ſin. } x}{1 + \text{cof. } h}\right\}.$$

Conceive now h to be continually diminiſhed, and we ſhall have the limit of $\frac{u'-u}{h}$ equal to the limit of $\frac{\text{ſin. } h}{h}$ multiplied by the limit of the following expreſſion

$$\text{cof. } x - \frac{\text{ſin. } h \text{ ſin. } x}{1 + \text{cof. } h}.$$

Now, the ſine of an arch being leſs than the arch itſelf, we have $\frac{\text{ſin. } h}{h} < 1$. Again, the arch being leſs than its tangent, $\frac{\text{ſin. } h}{h} > \frac{\text{ſin. } h}{\text{tan. } h}$; but tan. $h = \frac{\text{ſin. } h}{\text{cof. } h}$, and therefore $\frac{\text{ſin. } h}{\text{tan. } h} = \text{cof. } h$; conſequently $\frac{\text{ſin. } h}{h} > \text{cof. } h$. Hence it appears, that the expreſſion for the ratio $\frac{\text{ſin. } h}{h}$ is leſs than 1, or radius, but greater than cof. h. But h being conceived to be continually diminiſhed, cof. h continually approaches to 1, and may come nearer to it than by any aſſignable difference; therefore, the limit of $\frac{\text{ſin. } h}{h}$ is 1. As to the other expreſſion, cof. $x - \frac{\text{ſin. } h \text{ ſin. } x}{1 + \text{cof. } h}$; when h is ſuppoſed to be continually diminiſhed, its ſecond term, to wit, $\frac{\text{ſin. } h \text{ ſin. } x}{1 + \text{cof. } h}$ may become leſs than any aſſignable quantity; therefore the limit of the expreſſion is ſimply cof. x: thus, upon the whole, we have found that the limit of $\frac{u'-u}{h}$ is cof. x, and therefore

$$\frac{\dot{u}}{\dot{x}} = \text{cof. } x, \text{ and } \dot{u} = \dot{x} \text{ cof. } x.$$

The fluxion of the other function, $u = \text{cof. } x$, is eaſily deduced from that which we have juſt found, by proceeding thus:

Put c to denote a quadrant, then cof. $x = \text{ſin. } (c-x)$, and therefore

$$u = \text{ſin. } (c-x).$$

Now, it has been juſt ſhewn that

$$\text{flux. of ſin. } (c-x) = \text{cof. } (c-x) \times \text{flux. of } (c-x)$$

but cof. $(c-x) = \text{ſin. } x$, and the fluxion of $c-x$ is $-\dot{x}$, therefore

$$\dot{u} = -\dot{x} \text{ ſin. } x.$$

Thus it appears, that the fluxion of the ſine of a variable arch is equal to the fluxion of the arch multiplied by its coſine; and that the fluxion of the coſine is equal to the fluxion of the arch (taken with a negative ſign) multiplied by the ſine.

60. We can now very readily find the fluxion of any other function of an arch of a circle. Thus, ſuppoſe $u = \text{tan. } x$; then, becauſe tan. $x = \frac{\text{ſin. } x}{\text{cof. } x}$, we have $u = \frac{\text{ſin. } x}{\text{cof. } x}$. This expreſſion being conſidered as a fractional function of x, we have, by § 39, and what has been juſt now ſhewn,

$$\dot{u} = \frac{\dot{x} \text{ cof.}^2 x + \dot{x} \text{ ſin.}^2 x}{\text{cof.}^2 x},$$

$$= \frac{\dot{x}(\text{cof.}^2 x + \text{ſin.}^2 x)}{\text{cof.}^2 x};$$

or, ſince $\text{cof.}^2 x + \text{ſin.}^2 x = 1$, and $\frac{1}{\text{cof. } x} = \text{ſecant } x$,

$$\dot{u} = \frac{\dot{x}}{\text{cof.}^2 x} = \dot{x} \text{ ſec.}^2 x.$$

Hence alſo we have $\dot{x} = \frac{\dot{u}}{\text{ſec.}^2 x} = \frac{\dot{u}}{1 + u^2}$.

In like manner, if we ſuppoſe $u = \text{ſec. } x$, then, becauſe ſec. $x = \frac{1}{\text{cof. } x}$, we have $u = \frac{1}{\text{cof. } x}$, and

$$\dot{u} = \frac{\dot{x} \text{ ſin. } x}{\text{cof.}^2 x},$$

or, ſince $\frac{\text{ſin. } x}{\text{cof. } x} = \text{tan. } x$, and $\frac{1}{\text{cof. } x} = \text{ſec. } x$,

$$\dot{u} = \dot{x} \text{ tan. } x \text{ ſec. } x.$$

Proceeding in this manner, we find that when $u = \text{cotan. } x$, then

$$\dot{u} = \frac{-\dot{x}}{\text{tan.}^2 x \text{ cof.}^2 x} = \frac{-\dot{x}}{\text{ſin.}^2 x}$$

And when $u = \text{coſec. } x$, then

$$\dot{u} = \frac{-\dot{x} \text{ cof. } x}{\text{ſin.}^2 x} = -\dot{x} \text{ cotan. } x \text{ coſec. } x.$$

61. Let us now conſider the fluxions of geometrical magnitudes: And firſt let it be required to find the expreſſion for the fluxion of BDPC the area bounded by CP, a curve line, and by CB, PD, the ordinates at its extremities, and BD, the portion of AE, the line of the abſciſſas, which lies between thoſe ordinates. Let the numerical meaſures of AD and PD, the co-ordinates at the point P, be denoted by x and y, and the numerical meaſure of the area BDPC by s; then

Plate CCXIX. fig. 1.

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then y and s may both be conſidered as functions of the abſciſſa x.

Let x, or AD, be ſuppoſed to change its value, and to become AD', and let D'P', and BD'P'C be the correſponding new values of y and s; then DD', and DD'P'P will be the geometrical expreſſions for the ſimultaneous increments of the abſciſſa and area. But, as one of theſe quantities is a line, and the other a ſpace, they cannot be compared in reſpect of their ratio. Therefore, let us conſider a as denoting a line whoſe numerical value is unity, and then the numerical values of the increments of the abſciſſa and area may be conſidered as analogous to the geometrical quantities $DD' \times a$, and the area DD'P'P reſpectively, which quantities being homogeneous may now be compared with each other. We are now to inveſtigate the limit of $\frac{\text{area } DD'P'P}{a \times DD'}$, the general expreſſion for the ratio of the increments of s and x. Draw PM and P'N parallel to AE, meeting the ordinates in M and N. The curvilineal area DD'P'P is greater than the rectangle DD'MP, that is greater than $PD \times DD'$; but leſs than the rectangle DD'P'N, that is, leſs than $P'D' \times DD'$, therefore

$$\frac{\text{area } DD'P'P}{a \times DD'} > \frac{PD \times DD'}{a \times DD'} > \frac{PD}{a},$$

$$\text{and } \frac{\text{area } DD'P'P}{a \times DD'} < \frac{P'D' \times DD'}{a \times DD'} < \frac{P'D'}{a}.$$

But the increments being ſuppoſed to be continually diminiſhed, $\frac{PD}{a}$ is the limit of $\frac{P'D'}{a}$, therefore $\frac{PD}{a}$ is alſo the limit of $\frac{\text{area } DD'P'P}{a \times DD'}$, and hence (§ 21.)

$$\frac{\dot{s}}{\dot{x}} = \frac{PD}{a} = \frac{y}{1} = y, \text{ and } \dot{s} = y\,\dot{x}.$$

That is, the fluxion of a curvilineal area is equal to the product of the ordinate, and the fluxion of the abſciſſa.

62. Before we proceed to inveſtigate the expreſſion for the fluxion of an arch of a curve, it is neceſſary that we ſhould inquire what is the limiting ratio of an arch of a curve to its chord.

Fig. 2. Let APB be any curve line, all the parts of which are concave towards its chord AP. Let AQ, QP be tangents at the extremities of the arch, and let apq be a triangle ſimilar to APQ, but having its baſe ap of a given magnitude, then

$$AQ + QP : AP :: aq + qp : ap.$$

Suppoſe now the point P to approach to A, then the angles at A and P, and conſequently the angles at a and p, which are equal to them, will decreaſe, and may become leſs than any aſſignable angles; therefore, the limit of the ratio of $aq + qp$ to ap is evidently a ratio of equality; hence alſo the limit of the ratio of AQ + QP to AP is the ratio of equality; and ſince the arch AP is leſs than AQ + QP, but greater than its chord AP, the limit of the arch AP to its chord AP muſt alſo be the ratio of equality.

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63. We proceed now to find the fluxion of an arch of a curve. Let APP' be a curve line of any kind, and AB, BP any two co-ordinates at a point P in the curve. Put x for AB, the abſciſſa, y for BP, the ordinate, and z for the curve line AP, then z and y may be conſidered as each a function of x. Draw P'B' another ordinate, and draw PM parallel to AB, meeting P'B' in M, and draw the chord PP'; then PM, MP' and the arch PP' are the ſimultaneous increments of x, y, and z reſpectively. Now we have Fig. 3.

$$\frac{\text{arch } PP'}{PM} = \frac{\text{arch } PP'}{\text{chord } PP'} \times \frac{\text{chord } PP'}{PM.}$$

$$\text{But chord } PP' = \sqrt{(PM^2 + MP'^2)} = PM\sqrt{\left(1 + \frac{MP'^2}{PM^2}\right)};$$

herefore,

$$\frac{\text{arch } PP'}{PM} = \frac{\text{arch } PP'}{\text{chord } PP'} \times \sqrt{\left(1 + \frac{MP'^2}{PM^2}\right)}.$$

Suppoſe now the increments to be continually diminiſhed, then, as $\frac{\dot{z}}{\dot{x}}$ = limit of $\frac{\text{arch } PP'}{PM}$, and $\frac{\dot{y}^2}{\dot{x}^2}$ = limit of $\frac{MP'^2}{PM^2}$ (§ 21.), and 1 = limit of $\frac{\text{arch } PP'}{\text{chord } PP'}$ (laſt §) we have

$$\frac{\dot{z}}{\dot{x}} = \sqrt{\left(1 + \frac{\dot{y}^2}{\dot{x}^2}\right)}, \text{ and } \dot{z} = \sqrt{(\dot{x}^2 + \dot{y}^2)}.$$

Hence it appears that the ſquare of the fluxion of a curve line of any kind is equal to the ſum of the ſquares of the fluxions of the co-ordinates.

64. The expreſſion for the fluxion of a ſolid may be found by the ſame mode of reaſoning as that which we have employed, § 61, to find the fluxion of a curvilineal area. Let APQp be a portion of a ſolid generated by the revolution of APB, a curve line, about AC, a line taken in the plane of the curve, as an axis. Let PDp, P'D'p' be the lines in which BAb, a plane paſſing along the axis AC, meets PQp, P'Q'p', the planes of two circles formed by ſections of the ſolid perpendicular to its axis. Draw PM and P'N parallel to AD. Put AD = x, DP = y, let s denote the ſolid APQp, having y for the radius of its circular baſe, and x for its altitude; put π for the number 3·14159··· viz. the circumference of a circle having its diameter = 1, and let a denote an area, having its numerical meaſure expreſſed by unity; then, DD', or $a \times DD'$ being conſidered as the increment of x, the portion of the ſolid comprehended between the parallel planes PQp, P'Q'p' will be the correſponding increment of s, which we are to conſider as a function of x; hence (§ 21.) $\frac{\dot{s}}{\dot{x}}$ is Fig. 4.

equal to the limiting ratio of the portion of the ſolid, comprehended between the planes PQp, and P'Q'p' to the ſolid $a \times DD'$. But the former of theſe ſolids being evidently greater than a cylinder Pm, having the circle PQp for its baſe, and DD' for its altitude, that is greater than $\pi PD^2 \times DD'$, and leſs than a cylinder Np', having the circle P'Q'p' for its baſe, and DD' for its altitude, that is leſs than $\pi P'D'^2 \times DD'$;

it

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it follows, that as long as DD′ has an aſſignable magnitude,

$$\frac{\dot{s}}{\dot{x}} > \pi \, \mathrm{PD}^2 \times \mathrm{DD}' \times \frac{1}{a \times \mathrm{DD}'},$$

$$> \frac{\pi \, \mathrm{PD}^2}{a};$$

and $$\frac{\dot{s}}{\dot{x}} < \pi \, \mathrm{P}'\mathrm{D}'^2 \times \mathrm{DD}' \times \frac{1}{a \times \mathrm{DD}'},$$

$$< \frac{\pi \, \mathrm{P}'\mathrm{D}'^2}{a};$$

but the increment DD′ being continually diminiſhed, $\frac{\pi \, \mathrm{P}'\mathrm{D}'^2}{a}$, the greater limit of $\frac{\dot{s}}{\dot{x}}$, approaches continually to its leſſer limit $\frac{\pi \, \mathrm{PD}^2}{a} = \frac{\pi y^2}{a} =$ (becauſe $a=1$) πy^2, ſo as to come nearer to it than by any aſſignable difference, therefore $\frac{\dot{s}}{\dot{x}} = \pi y^2$, and $\dot{s} = \pi y^2 \dot{x}$. Now, if we obſerve that πy^2 is the area of the circle PQp, it will appear, *that the fluxion of a ſolid generated by the revolution of a curve about its axis is equal to the fluxion of the axis multiplied by the general expreſſion for the area of a circle formed by ſuppoſing the ſolid to be cut by a plane perpendicular to its axis.*

65. To find the fluxion of the ſurface of the ſolid, let us denote that ſurface by s, and let x and y denote as before; then the ſurface contained between the circles PQp and P′Q′p′ will be the increment of s, correſponding to DD′ the increment of x. Draw the chord PP′; then, the curve line PP′ being ſuppoſed to revolve about the axis AC, and thus to generate the increment of the ſurface of the ſolid, the chord PP′ will generate at the ſame time the convex ſurface of a fruſtum of a cone; now the limiting ratio of the curve line PP′ to its chord PP′ being the ratio of equality, the limiting ratio of the ſurfaces generated by the revolution of thoſe lines will alſo be the ratio of equality; therefore $\frac{\dot{s}}{\dot{x}}$, which is equal to the limit of

Fig. 5.

$$\frac{\text{ſurf. gener. by arch PP}'}{1 \times \mathrm{DD}'}$$

will alſo be equal to the limit of

$$\frac{\text{ſurf. gener. by chord PP}'}{\mathrm{DD}'};$$

but the convex ſurface of a fruſtum of a cone is equal to the product of its ſlant ſide into half the ſum of the circumferences of its two baſes (ſee GEOMETRY), and in the preſent caſe theſe circumferences are equal to 2 PD $\times \pi$, and 2 P′D′ $\times \pi$, therefore $\frac{\dot{s}}{\dot{x}}$ is equal to the limit of

$$\frac{\pi \, (\mathrm{PD} + \mathrm{P}'\mathrm{D}') \, \mathrm{PP}'}{\mathrm{DD}'} = \pi (\mathrm{PD} + \mathrm{P}'\mathrm{D}') \frac{\mathrm{PP}'}{\mathrm{DD}'};$$

but the point D′ being ſuppoſed to approach to D, the limit of PD + P′D′, will manifeſtly be 2 PD $= 2y$; and ſince $\frac{\mathrm{PP}'}{\mathrm{DD}'} = \frac{\sqrt{(\mathrm{DD}'^2 + \mathrm{P}'\mathrm{M}^2)}}{\mathrm{DD}'} = \sqrt{\left(1 + \frac{\mathrm{P}'\mathrm{M}^2}{\mathrm{DD}'^2}\right)}$, the limit of this expreſſion (if we conſider that P′M and DD′ are the ſimultaneous increments of y and x) is evidently equal to $\sqrt{\left(1 + \frac{\dot{y}^2}{\dot{x}^2}\right)}$, therefore

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$$\frac{\dot{s}}{\dot{x}} = 2 \pi y \sqrt{\left(1 + \frac{\dot{y}^2}{\dot{x}^2}\right)},$$

and conſequently

$$\dot{s} = 2 \pi y \sqrt{(\dot{x}^2 + \dot{y}^2)}.$$

If we now obſerve that $2 \pi y$ is the circumference of the circle PQp, and $\sqrt{(\dot{x}^2 + \dot{y}^2)}$ is the fluxion of the curve line AP, § 63, it will appear, *that the fluxion of the ſurface of a ſolid generated by the revolution of a curve about its axis is equal to the fluxion of the curve line multiplied by the general expreſſion for the circumference of a circle formed by ſuppoſing the curve to be cut by a plane perpendicular to its axis.*

SECT. III. *The Application of the Direct Method of Fluxions.*

HAVING explained the principles of the direct method of fluxions at as great a length as we think ſuitable to the work of which this treatiſe forms a part, we proceed to ſhew how the calculus may be applied to the reſolution of ſome general problems in Analyſis and Geometry.

Inveſtigation of a general formula for expanding a Function into a Series.

66. In treating of the principles of the method of fluxions, we have from an examination of particular functions, inferred by induction, that u being any function of a variable quantity x, which was either actually expreſſed, or capable of being expreſſed by a combination of the powers of x, then, x being ſuppoſed to change its value, and to become $x+h$, the new value which the function u will acquire when $x+h$ is ſubſtituted in it inſtead of x will always be capable of being expanded into a ſeries of this form,

$$u + p\,h + q\,h^2 + r\,h^3 + \&c.$$

where p, q, &c. denote functions of x that are quite independent of h.

We have ſhewn that, from the particular form of this developement, it happens that the ratio of $p\,h + q\,h^2 + r\,h^3 +$ &c. the increment of the function, to h the increment of the variable quantity x itſelf, admits of a limit, which is always expreſſed by p, the coefficient of its ſecond term; and as we have defined this limit to be the expreſſion for the ratio of the fluxions of u and x, ſo that $p = \frac{\dot{u}}{\dot{x}}$, the new value of the function may alſo be expreſſed thus

$$u + \frac{\dot{u}}{\dot{x}} h + q\,h^2 + r\,h^3 + \&c.$$

And

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And this expreſſion may be conſidered as indicating not only the general form of the ſeries, but alſo the particular relation ſubſiſting between u, the original function, and p, the coefficient of the ſecond term of the ſeries, the latter being in every caſe that function of x which reſults from the operation of taking the fluxion of the former, and dividing by $\dot{x}$.

We are now to inveſtigate the relation that ſubſiſts between each of the remaining coefficients and the original function.

67. Firſt let us ſuppoſe the function u to have the particular form x^n, n being a conſtant number. Then x changing its value to $x+h$, u changes to $u'=(x+h)^n$, therefore, by the binomial theorem (§ 52.)

$$u'=x^n+n\,x^{n-1}\,h+\frac{n\,(n-1)}{2}\,x^{n-2}\,h^2 + \frac{n\,(n-1)\,(n-2)}{2\cdot 3}\,x^{n-3}\,h^3+\&c.$$

But ſince $u=x^n$, by taking the ſucceſſive fluxions of u, and conſidering x as conſtant, we have,

$$\frac{\dot{u}}{\dot{x}}=n\,x^{n-1},$$

$$\frac{\ddot{u}}{\dot{x}^2}=n\,(n-1)\,x^{n-2},$$

$$\frac{\dddot{u}}{\dot{x}^3}=n\,(n-1)\,(n-2)\,x^{n-3},$$

$$\frac{\ddddot{u}}{\dot{x}^4}=n\,(n-1)\,(n-2)\,(n-3)\,x^{n-4}.$$

&c.

Let $u, \frac{\dot{u}}{\dot{x}}, \frac{\ddot{u}}{\dot{x}^2}$ &c. be now ſubſtituted for x^n, $n\,x^{n-1}$, $n\,(n-1)\,x^{n-2}$, &c. reſpectively, in the ſeries for u', and we have

$$u'=u+\frac{\dot{u}}{\dot{x}}\,h+\frac{\ddot{u}}{\dot{x}^2}\,\frac{h^2}{2}+\frac{\dddot{u}}{\dot{x}^3}\,\frac{h^3}{2\cdot 3}+\frac{\ddddot{u}}{\dot{x}^4}\,\frac{h^4}{2\cdot 3\cdot 4}+\&c.$$

68. This manner of expreſſing the developement of u', or $(x+h)^n$, indicates directly the relation that each of the coefficients of the ſucceſſive powers of h has to the original function.

The firſt term of the ſeries is the original function u, or x^n, itſelf, or it is what the function $(x+h)^n$ becomes upon the ſuppoſition that $h=0$. The ſecond term is h, or $\frac{h}{1}$, multiplied by the coefficient $\frac{\dot{u}}{\dot{x}}$, which coefficient is a function of x derived from the original function by the operation of taking its fluxion, and dividing the reſult by $\dot{x}$. The third term is $\frac{h^2}{1.2}$ multiplied by the coefficient $\frac{\ddot{u}}{\dot{x}^2}$, that is, by a function of x derived from the preceding coefficient $\frac{\dot{u}}{\dot{x}}$ by the ſame operation as that coefficient was derived from the original function, namely by taking the fluxion of $\frac{\dot{u}}{\dot{x}}$, conſidering $\dot{x}$ as conſtant, and dividing by $\dot{x}$. The fourth term is $\frac{h^3}{1.2.3}$ multiplied by $\frac{\dddot{u}}{\dot{x}^3}$, that is, by a function of x deduced from the third coefficient by the very ſame operation as that by which the third was derived from the ſecond, or the ſecond from the firſt. And ſo on with reſpect to all the other terms of the ſeries, the nth term being the product of $\frac{h^{n-1}}{1.2.3\ldots(n-1)}$, and the $(n-1)$th fluxion of the function u divided by $\dot{x}^{n-1}$.

69. Let us now ſuppoſe that u denotes any other function of x, then, whatever be its nature, it may always be conceived as capable of being expreſſed by a ſeries, the terms of which are powers of x, in this manner;

$$A\,x^a+B\,x^b+C\,x^c+D\,x^d+\&c.$$

where A, B, C, &c. a, b, c, &c. denote conſtant numbers. Thus we have

$$u=A\,x^a+B\,x^b+C\,x^c+\&c.$$

Then, x being ſuppoſed to become $x+h$, and (in conſequence of the change in the value of x) u to become u', we have

$$u'=A\,(x+h)^a+B\,(x+h)^b+C\,(x+h)^c+\&c.$$

Let us now denote $A\,x^a$ by P, $B\,x^b$ by Q, $C\,x^c$ by R, &c. then by laſt §

$$A\,(x+h)^a=P+\frac{\dot{P}}{\dot{x}}\,h+\frac{\ddot{P}}{\dot{x}^2}\,\frac{h^2}{2}+\frac{\dddot{P}}{\dot{x}^3}\,\frac{h^3}{2\cdot 3}+\&c.$$

$$B\,(x+h)^b=Q+\frac{\dot{Q}}{\dot{x}}\,h+\frac{\ddot{Q}}{\dot{x}^2}\,\frac{h^2}{2}+\frac{\dddot{Q}}{\dot{x}^3}\,\frac{h^3}{2\cdot 3}+\&c.$$

$$C\,(x+h)^c=R+\frac{\dot{R}}{\dot{x}}\,h+\frac{\ddot{R}}{\dot{x}^2}\,\frac{h^2}{2}+\frac{\dddot{R}}{\dot{x}^3}\,\frac{h^3}{2\cdot 3}+\&c.$$

&c.

Therefore, ſubſtituting theſe developements in the ſeries expreſſing u',

$$u'=\begin{cases} P+Q+R+\&c. \\ +\left(\frac{\dot{P}}{\dot{x}}+\frac{\dot{Q}}{\dot{x}}+\frac{\dot{R}}{\dot{x}}+\&c.\right)h \\ +\left(\frac{\ddot{P}}{\dot{x}^2}+\frac{\ddot{Q}}{\dot{x}^2}+\frac{\ddot{R}}{\dot{x}^2}+\&c.\right)\frac{h^2}{2} \\ +\left(\frac{\dddot{P}}{\dot{x}^3}+\frac{\dddot{Q}}{\dot{x}^3}+\frac{\dddot{R}}{\dot{x}^3}+\&c.\right)\frac{h^3}{2\cdot 3} \\ +\&c. \end{cases}$$

But

$$u=P+Q+R+\&c.$$

$$\frac{\dot{u}}{\dot{x}}=\frac{\dot{P}}{\dot{x}}+\frac{\dot{Q}}{\dot{x}}+\frac{\dot{R}}{\dot{x}}+\&c.$$

$$\frac{\ddot{u}}{\dot{x}^2}=\frac{\ddot{P}}{\dot{x}^2}+\frac{\ddot{Q}}{\dot{x}^2}+\frac{\ddot{R}}{\dot{x}^2}+\&c.$$

$\&c.$

Therefore, ſubſtituting $u, \frac{\dot{u}}{\dot{x}}$, &c. for the ſeries to which they are reſpectively equal,

$$u'=u+\frac{\dot{u}}{\dot{x}}\frac{h}{1}+\frac{\ddot{u}}{\dot{x}^2}\frac{h^2}{1.2}+\frac{\dot{\ddot{u}}}{\dot{x}^3}\frac{h^3}{1.2.3}+\&c.$$

Hence it appears that u being any function of x whatever, if $x+h$ be ſubſtituted in that function inſtead of x, the ſeries expreſſing the developement of this new value of the function will have the general properties which have been ſhewn, in laſt §, to belong to it in the caſe of the function having the particular value x^n.

The very general theorem which we have juſt now inveſtigated is one of the moſt elegant and important in analyſis. It was firſt publiſhed by *Dr Brooke Taylor* in a work entitled *Methodus Incrementorum*, which made its appearance about the year 1716. The theorem itſelf is generally known by the name of *Taylor's* theorem. It is more general than the celebrated *Binomial* theorem, inaſmuch as this laſt, and innumerable others, are comprehended in it as particular caſes.

70. We ſhall now give ſome examples to ſhew the manner of applying Taylor's theorem, as well as its great utility as an inſtrument of analyſis.

Example 1. Suppoſe $u=a^x$, a being conſtant and x variable. Then x becoming $x+h$, u becomes $u'=a^{x+h}$. Now from the equation $u=a^x$ we derive (§ 56.) $\frac{\dot{u}}{\dot{x}}=A\,a^x$ (here A denotes $\frac{\log. a}{\log. e}$). Again, conſidering $\dot{x}$ as conſtant, and repeating the operation of taking the fluxion on $\frac{\dot{u}}{\dot{x}}=A\,a^x$, we get $\frac{\ddot{u}}{\dot{x}^2}=A^2a^x$, and hence again $\frac{\dot{\ddot{u}}}{\dot{x}^3}=A^3\,a^x$, &c. Therefore, ſubſtituting for u', u, $\frac{\dot{u}}{\dot{x}}$, $\frac{\ddot{u}}{\dot{x}^2}$, &c. their values in the general theorem $u'=u+\frac{\dot{u}}{\dot{x}}h+\frac{\ddot{u}}{\dot{x}^2}\frac{h^2}{2}+\&c.$ it becomes

$$a^{x+b}=a^x\left(1+A\,h+\frac{A^2}{2}h^2+\frac{A^3}{2.3}h^3+\&c.\right)$$

Suppoſe now, that $x=0$, then, as in this caſe $a^x=1$, we have

$$a^h=1+A\,h+\frac{A^2}{2}h^2+\frac{A^3}{2.3}h^3+\&c.$$

or, exchanging h for x

$$a^x=1+Ax+\frac{A^2x^2}{2}+\frac{A^3x^3}{2.3}+\&c.$$

the ſame reſult as we formerly obtained in § 54.

Ex. 2. Suppoſe $u=\log. x$. Then, x becoming $x+h$, u becomes $u'=\log.(x+h)$. Now from the equation $u=\log. x$, we find (by § 57.) $\frac{\dot{u}}{\dot{x}}=\frac{M}{x}$. Here M denotes the modulus of the ſyſtem. Again, ſuppoſing $\dot{x}$ conſtant, we find by § 26, $\frac{\ddot{u}}{\dot{x}^2}=-\frac{M}{x^2}$, $\frac{\dot{\ddot{u}}}{\dot{x}^3}=\frac{2M}{x^3}$ $\therefore u=-\frac{2.3M}{x^3}$ &c. Therefore, ſubſtituting as before the values of u', u, $\frac{\dot{u}}{\dot{x}}$, &c. in the general formula $u'=u+\frac{\dot{u}}{\dot{x}}h+\frac{\ddot{u}}{\dot{x}^2}\frac{h^2}{2}+\&c.$ it becomes

$$\log.(x+h)=\log. x+\frac{M}{x}h-\frac{M}{2x^2}h^2+\frac{M}{3x^3}h^3-\&c.$$

If we ſuppoſe $x=1$, and change h into y, we have, becauſe $\log. x=\log. 1=0$,

$$\log.(1+y)=M\left(y-\frac{y^2}{2}+\frac{y^3}{3}-\&c.\right)$$

For the particular method of applying theſe two ſeries to the calculation of logarithms, ſee ALGEBRA § 285 to § 291. See alſo LOGARITHMS.

Ex. 3. Suppoſe now $u=\text{ſin. } x$. Then $u'=\text{ſin. }(x+h)$. From $u=\text{ſin. } x$, by the application of the rule in § 59, we deduce $\frac{\dot{u}}{\dot{x}}=\text{cof. } x$, $\frac{\ddot{u}}{\dot{x}^2}=-\text{ſin. } x$, $\frac{\dot{\ddot{u}}}{\dot{x}^3}=-\text{cof. } x$, $\frac{\dot{\ddot{u}}}{\dot{x}^4}=\text{ſin. } x$, &c. Therefore, ſubſtituting for u', u, $\frac{\dot{u}}{\dot{x}}$, &c. their values in the general formula as before, we have

$$\text{ſin. }(x+h)=\text{ſin. } x+\text{cof. } x\frac{h}{1}-\text{ſin. } x.\frac{h^2}{1.2}-\text{cof. } x\frac{h^3}{1.2.3}+\text{ſin. } x\frac{h^4}{1.2.3.4}+\&c.$$

or ſin. $(x+h)$ is equal to

$$\text{ſin. } x\left(1-\frac{h^2}{2}+\frac{h^4}{1.2.3.4}-\&c.\right)+\text{cof. } x\left(h-\frac{h^3}{1.2.3}+\frac{h^5}{1.2.3.4.5}-\&c.\right)$$

If we ſuppoſe $x=0$, then, as in that caſe ſin. $x=0$, the preceding formula becomes

ſin.

$$\text{fin. } h = h - \frac{h^3}{1\cdot2\cdot3} + \frac{h^5}{1\cdot2\cdot3\cdot4\cdot5} - \&c.$$

or, fubſtituting x inſtead of h,

$$\text{fin. } x = x - \frac{x^3}{1\cdot2\cdot3} + \frac{x^5}{1\cdot2\cdot3\cdot4\cdot5} - \&c.$$

Ex. 4. Suppoſe $u = \text{cof. } x$, then $u' = \text{cof. } (x+h)$, and ſince $u = \text{cof. } x$, by § 59, $\frac{\dot{u}}{\dot{x}} = -\text{fin. } x$, $\frac{\ddot{u}}{\dot{x}^2} = -\text{cof. } x$, $\frac{\dot{\ddot{u}}}{\dot{x}^3} = \text{fin. } x$, &c. Therefore, fubſtituting as before theſe values in the general formula $u' = u + \frac{\dot{u}}{\dot{x}}h +$ &c. it becomes

$$\text{cof. } (x+h) = \text{cof. } x - \text{fin. } x\,\frac{h}{1} - \text{cof. } x\,\frac{h^2}{1\cdot2} + \text{fin. } x\,\frac{h^3}{1\cdot2\cdot3} + \&c.$$

or cof. $(x+h)$ is equal to

$$\text{cof. } x\left(1 - \frac{h^2}{1\cdot2} + \frac{h^4}{1\cdot2\cdot3\cdot4} - \&c.\right) - \text{fin } x\left(h - \frac{h^3}{1\cdot2\cdot3} + \frac{h^5}{1\cdot2\cdot3\cdot4\cdot5} - \&c.\right)$$

which expreſſion, when $x=0$, and therefore cof. $x=1$, fin. $x=0$, becomes ſimply

$$\text{cof. } h = 1 - \frac{h^2}{1\cdot2} + \frac{h^4}{1\cdot2\cdot3\cdot4} - \&c.$$

or ſubſtituting x for h,

$$\text{cof. } x = 1 - \frac{x^2}{1\cdot2} + \frac{x^4}{1\cdot2\cdot3\cdot4} - \&c.$$

71. It may be remarked that in each of theſe examples, from the developement of u' the new value of the function u, we have been able to deduce a developement of u the function itſelf. But it is eaſy to ſee, that by proceeding in the ſame manner with the general formula as we have done in theſe particular examples, we ſhall obtain a general expreſſion for the developement of any function whatever.

The general formula is

$$u' = u + \frac{\dot{u}}{\dot{x}}\frac{h}{1} + \frac{\ddot{u}}{\dot{x}^2}\frac{h^2}{1.2} + \frac{\dot{\ddot{u}}}{\dot{x}^3}\frac{h^3}{1.2.3} + \&c.$$

Now, u' being the value that u aſſumes when $x+h$ is ſubſtituted in it inſtead of x, if we ſuppoſe $x=0$, then u' becomes the very ſame function of h, that u is of x. Let us denote the values which each of the functions u, $\frac{\dot{u}}{\dot{x}}$, $\frac{\ddot{u}}{\dot{x}^2}$, &c. acquire, when $x=0$, by U, U′, U″ &c. reſpectively.

Then (F) u' (conſidered as the ſame function of h that u is of x) is equal to

$$U + U'\frac{h}{1} + U''\frac{h^2}{1\cdot2} + U'''\frac{h^3}{1\cdot2\cdot3} + \&c.$$

Let x be now ſuppoſed to be ſubſtituted both in u', and the ſeries which is its developement inſtead of h, then u' becomes u, and we have

$$u = U + U'\frac{x}{1} + U''\frac{x^2}{1\cdot2} + U'''\frac{x^3}{1\cdot2\cdot3} + \&c.$$

and in this formula it is to be conſidered, as already ſtated, that U, U′, U″, &c. denote the particular values which the functions u, $\frac{\dot{u}}{\dot{x}}$, $\frac{\ddot{u}}{\dot{x}^2}$, $\frac{\dot{\ddot{u}}}{\dot{x}^3}$, &c. acquire reſpectively, by ſuppoſing that in each of them x is taken $=0$.

72. As an example of the application of this ſeries let us reſume the equation $u = a^x$, then $\frac{\dot{u}}{\dot{x}} = Aa^x$ (§ 56.), $\frac{\ddot{u}}{\dot{x}^2} = A^2 a^x$, $\frac{\dot{\ddot{u}}}{\dot{x}^3} = A^3 a^x$, &c.

Suppoſe now that $x=0$, then u, or a^x becomes $a^0 = 1$, $\frac{\dot{u}}{\dot{x}} = A\,a^x$ becomes A, $\frac{\ddot{u}}{\dot{x}^2} = A^2 a^x$ becomes A^2, &c. ſo that $U=1$, $U'=A$, $U''=A^2$, &c. ſubſtituting therefore theſe values in the general formula, it becomes

$$a^x = 1 + A\,\frac{x}{1} + A^2\,\frac{x^2}{1\cdot2} + A^3\,\frac{x^3}{1\cdot2\cdot3} + \&c.$$

Let us next ſuppoſe that u is an arch of a circle of which the ſine is x (radius being unity), then $x = \text{fin. } u$. Now the ratio of the fluxion of u to the fluxion of x will be the very ſame whether we conſider u as a function of x, or x as a function of u; therefore (§ 59.) $\dot{x} = \dot{u}\,\text{cof. } u$, and $\frac{\dot{u}}{\dot{x}} = \frac{1}{\text{cof. } u}$, but ſince fin. $u = x$, cof. $u = \sqrt{(1-x^2)}$, therefore,

$$\frac{\dot{u}}{\dot{x}} = \frac{1}{\sqrt{(1-x^2)}}.$$

(F) For the ſake of illuſtration let us take a particular example. Suppoſe $u = (a+x)^n$, then $\frac{\dot{u}}{\dot{x}} = n(a+x)^{n-1}$, $\frac{\ddot{u}}{\dot{x}^2} = n(n-1)(a+x)^{n-2}$, &c. Suppoſe now that $x=0$, then u becomes a^n, $\frac{\dot{u}}{\dot{x}}$ becomes $n\,a^{n-1}$, $\frac{\ddot{u}}{\dot{x}^2}$ becomes $n(n-1)a^{n-2}$, &c. ſo that in this particular caſe we have $U = a^n$, $U' = n\,a^{n-1}$, $U'' = n(n-1)a^{n-2}$, &c.

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Taking now the fluxion of $\frac{1}{\sqrt{(1-x^2)}}$, and the fluxion of the refult &c. we have

$$\frac{\ddot{u}}{\dot{x}^2}=\frac{x}{(1-x^2)^{\frac{3}{2}}},$$

$$\frac{\dddot{u}}{\dot{x}^3}=\frac{1}{(1-x^2)^{\frac{3}{2}}}+\frac{3x^2}{(1-x^2)^{\frac{5}{2}}},$$

$$\frac{\ddddot{u}}{\dot{x}^4}=\frac{3\cdot 3x}{(1-x^2)^{\frac{5}{2}}}+\frac{3\cdot 5x^3}{(1-x^2)^{\frac{7}{2}}},$$

&c.

Suppoſe now that $x=0$, then u becomes 0, $\frac{\dot{u}}{\dot{x}}$ becomes 1, $\frac{\ddot{u}}{\dot{x}^2}$ becomes 0, $\frac{\dddot{u}}{\dot{x}^3}$ becomes 1, $\frac{\ddddot{u}}{\dot{x}^4}$ becomes 0, &c. ſo that $U=0$, $U'=1$, $U''=0$, $U'''=1$, $U''''=0$, &c. Therefore, ſubſtituting in the general formula, we find

$$u=x+\frac{x^3}{1.2.3}+\text{ &c.}$$

By proſecuting the computations farther, we may find

$$u=x+\frac{1^2x^3}{2.3}+\frac{3^2x^5}{2.3.4.5}+\frac{3^2.5^2x^7}{2.3.4.5.6.7}+\text{&c.}$$

Application of the Method of Fluxions to the drawing of Tangents.

73. The theory of tangents to curve lines furniſhes a good illuſtration of the truth of the principle which we have conſidered as the foundation of the method of fluxions, namely, that whatever be the form of a function, the ratio of its increment to the increment of the variable quantity from which the function is formed, is in every caſe ſuſceptible of a limit.

Fig. 6. Let AB, the abſciſſa of a curve, be the geometrical expreſſion of a variable quantity x, and let BP the correſponding ordinate, be the expreſſion for y, any function of x; then the curve line itſelf is the locus of the equation expreſſing the relation between x and y. Let PT, a tangent to the curve at P, meet AB the abſciſſa in T; through P draw any ſtraight line meeting the abſciſſa in D, and the curve in p; draw the ordinate pb, and from P draw P n parallel to the abſciſſa, meeting the ordinate bp in n.

The triangles DBP, Pnp are ſimilar; therefore

$$pn : n\,\mathrm{P} :: \mathrm{PB} : \mathrm{BD}.$$

Now pn, and nP, or Bb, are the increments of PB and BA, or of y and x reſpectively, therefore the ratio of the ſimultaneous increments of PB and BA, or y and x, whatever be their magnitudes, is equal to the ratio of PB to BD. Conceive now the point p to approach continually to P, then the angle contained by the ſtraight line pPD, and the tangent PT, will decreaſe, and the point D will approach to T; at the ſame time np, and nP, the increments of y and x will be continually diminiſhed; ſtill, however, they will have to each other the ratio of PB to BD, but this ratio approaches continually to the ratio of PB to BT, and becomes at laſt more nearly equal to it than any aſſignable ratio; therefore the ratio of PB to BT is the limit of the ratio of PB to BD, and conſequently is alſo the limit of the ratio of pn, the increment of y to nP, the increment of x. And as this concluſion does not depend upon the particular nature of the curve, or upon any particular relation ſuppoſed to ſubſiſt between x and y, we may conclude, that whatever be the form of the function, the ratio of the ſimultaneous increments of the function, and the variable quantity from which it is formed, has a limit to which it approaches when the increments are conceived to be continually diminiſhed.

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It is now eaſy to ſee how the method of fluxions may be applied to the determination of tangents to curves, for ſince the ratio of the ordinate PB to the ſubtangent BT is always the limiting ratio of the increments of the ordinate and abſciſſa, it is equal to the ratio of their fluxions, that is

$$\dot{y} : \dot{x} :: y : \text{ſubtan. BT}.$$

Hence in any curve whatever, referred to an axis, the ſubtangent, (that is, the ſegment of the abſciſſa between the ordinate and tangent) is equal to $\frac{\dot{x}}{\dot{y}}y$ where x denotes the abſciſſa, and y the ordinate at the point of contact; and the ſubtangent being found, the poſition of the tangent is thereby determined.

Let us apply the above general formula to ſome examples.

Example 1. Let the propoſed curve be a circle. It is required to determine the poſition of PT, a tangent at any point P in its circumference. Fig. 7.

Put $2a$ for AE the diameter, alſo x for AB the abſciſſa, and y for BP the ordinate at the point of contact.

From the nature of the curve, we have

$$\mathrm{AB}\times\mathrm{BE}=\mathrm{BP}^2, \text{ that is}$$

$$x(2a-x)=y^2.$$

Hence taking the relations of the fluxions of x and y; we have

$$2ax-2x\dot{x}=2y\dot{y},$$

$$\text{therefore } \frac{\dot{x}}{\dot{y}}=\frac{y}{a-x},$$

$$\text{and BT}=\frac{\dot{x}}{\dot{y}}y=\frac{y^2}{a-x};$$

from which it appears that BT the ſub-tangent is a third proportional to $a-x$ and y, that is, to CB the diſtance of the ordinate from the centre, and BP the ordinate, agreeing with what is known from the elements of geometry.

Ex. 2. Let the curve be a parabola, required the ſame as before. Fig. 8.

Put x for AB, the abſciſſa, and y for BP the ordinate at P the point of contact; alſo a for the parameter; then, from the nature of the curve

$$\mathrm{PB}^2=a\times\mathrm{AB}, \text{ that is}$$

$$ax=y^2$$

therefore,

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therefore, taking the fluxions, we get $a\dot{x} = 2y\dot{y}$, and

$$\frac{\dot{x}}{\dot{y}} = \frac{2y}{a}, \text{ and}$$

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{2y^2}{a} = \frac{2ax}{a} = 2x;$$

from which it appears that the sub-tangent BT is double the abscissa BA.

Fig. 9. *Ex.* 3. Let the curve be an ellipse.

Put AB$=x$, BP$=y$, AC, the semi-transverse axis $=a$, CH the semi-conjugate axis$=b$.

The nature of the curve is such, that

$$AC^2 : CH^2 :: AB \times BE : BP^2$$

or $a^2 : b^2 :: (2a - x)\, x : y^2$

Hence $a^2 y^2 = b^2 (2a - x)\, x$,

and taking the relation of the fluxions,

$$a^2 y\dot{y} = b^2 (a - x)\dot{x};$$

$$\text{Therefore } \frac{\dot{x}}{\dot{y}} = \frac{a^2 y}{b^2 (a - x)}, \text{ and}$$

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{a^2 y^2}{b^2 (a - x)}.$$

But from the preceding equation expressing the nature of the curve, $\frac{ay^2}{b^2} = (2a - x)\, x$; therefore

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{(2a - x)\, x}{a - x}.$$

To this expression for BT, let BC$=a - x$ be added, and we have

$$CT = a - x + \frac{(2a - x)\, x}{a - x} = \frac{a^2}{a - x};$$

from which it appears that CB : CA :: CA : CT.

Fig. 10. *Ex.* 4. Suppose the curve to be a hyperbola, and let it be required to find, as in the preceding examples.

Put a and b as in the case of the ellipse to express the semitransverse and semiconjugate axes, then the equation of the curve is

$$a^2 y^2 = b^2 (2a + x)\, x,$$

and taking the relation of the fluxions,

$$a^2 y\dot{y} = b^2 (a + x)\dot{x},$$

from which we find

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{a^2 y^2}{b^2 (a + x)},$$

or, substituting $(2a + x)\, x$ for $\frac{a^2 y^2}{b^2}$,

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{(2a + x)\, x}{a + x}.$$

Let this expression for BT be subtracted from the expression for CB, that is from $a + x$, and we have

$$CT = a + x - \frac{2ax + x^2}{a + x} = \frac{a^2}{a + x},$$

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therefore CB : CA :: CA : CT.

Fig. 11. *Ex.* 5. Suppose the curve APD to be a cycloid, of which AE is the axis, and AQE a semicircle described on the axis as a diameter. Suppose AC, the radius, to be unity; put AB$=x$, BP$=y$, and the arch AQ$=v$; then, AB$=1 -$ cos. v, and BQ$=$ sin. v. Now, from the nature of the curve, PB$=$ arch AQ$+$ BQ; hence we have

$$x = 1 - \text{cos. } v, \qquad y = v + \text{sin. } v,$$

and taking the fluxions, by § 59,

$$\dot{x} = \dot{v}\, \text{sin. } v, \qquad \dot{y} = \dot{v} + \dot{v}\, \text{cos. } v;$$

therefore,

$$BT = \frac{\dot{x}}{\dot{y}}\, y = \frac{\dot{v}\, y\, \text{sin. } v}{\dot{v} + \dot{v}\, \text{cos. } v} = \frac{y\, \text{sin. } v}{1 + \text{cos. } v}$$

$$= \frac{PB \times BQ}{EB};$$

but from the nature of the circle $\frac{BQ}{EB} = \frac{AB}{BQ}$, therefore, $BT = \frac{PB \times AB}{BQ}$, and consequently BQ : BA :: BP : BT, from which it appears that if the chord AQ be drawn, the tangent PT is parallel to the chord QA.

Fig. 6. 74. If PT be a tangent to the curve AP at the point P, and PC be drawn perpendicular to the tangent, meeting AC the axis of the curve in C, then the line PC is called a *normal* to the curve at the point P; and EC, the distance between the ordinate and the extremity of the normal, is called the *sub-normal*.

The triangles TBP, BPC being similar, we have TB : BP :: BP : BC; or, since TB : BP :: $\dot{x} : \dot{y}$, (§ 73) $\dot{x} : \dot{y} :: y :$ BC, hence in any curve, BC the sub-normal is equal to $\frac{y\dot{y}}{\dot{x}}$; and from this expression, we may find the sub-normal in the same way as we have found the sub-tangent in the examples of last §.

75. As by plane trigonometry

TB : BP :: rad. : tangent of T,

and from § 73, TB : BP :: $\dot{x} : \dot{y}$,

therefore $\dot{x} : \dot{y} :: 1 :$ tan. T,

hence it appears that $\frac{\dot{y}}{\dot{x}}$ expresses the numeral tangent of the angle T, that is the angle contained by a tangent to the curve, and the axis of the curve. In like manner we have

$$\dot{y} : \dot{x} :: BP : BD :: CB : BP :: 1 : \text{tan. C},$$

therefore $\frac{\dot{x}}{\dot{y}}$ expresses the tangent of the angle C, that is the angle contained by a normal to the curve and its axis.

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Application of Fluxions to Problems relating to MAXIMA *and* MINIMA.

76. If a variable quantity be ſuppoſed to change its magnitude, then any function of that quantity will alſo change its magnitude. When the variable quantity is ſuppoſed to increaſe continually ſo as to acquire ſucceſſively all degrees of magnitude, there are ſome functions of ſuch a form, that they either increaſe continually, or decreaſe continually; but there are others again which either increaſe to a certain limit, after which they decreaſe; or elſe they decreaſe to a certain limit, after which they increaſe.

If, in conſequence of the continual increaſe of a variable quantity, a function of that quantity firſt increaſes to a certain limit, and afterwards decreaſes, when it arrives at that limit it is then ſaid to be a *maximum*. Or if it decreaſe to a certain limit, and afterwards increaſe, when it arrives at that limit, it is then ſaid to be a *minimum*.

77. Let us conſider the function $y = b - (x - a)^2$. If we ſuppoſe $x = 0$, then $y = b - a^2$. Suppoſe now x to be at firſt very ſmall, and to increaſe; then as $(x-a)^2$ will decreaſe, y will alſo increaſe, till x become $= a$, and then y will become $= b$, when it is a *maximum*; for x being ſuppoſed to become greater than a, y will be leſs than b. By ſuppoſing x to increaſe till $(x-a)^2$ become equal to b, then y will decreaſe to 0; and x being ſtill ſuppoſed to increaſe, y will become negative.

Let us next ſuppoſe $y = b + (x-a)^2$. In this caſe when $x = 0$, $y = b + a^2$; as x increaſes, $(x-a)^2$ decreaſes, and conſequently y decreaſes, till $x = a$, and then $y = b$, a *minimum*; for x becoming greater than a, y becomes greater than b.

78. Every function that either increaſes or decreaſes continually has neither *maximum* nor *minimum*; for for whatever value ſuch a function may acquire, in the one caſe it may always have a greater, and in the other a leſs value.

The characteriſtic property of a *maximum* value of a function, by which it is made the object of analytical inquiry, conſiſts in its being greater than the values immediately preceding, and alſo greater than the values immediately following it; and that of a *minimum* conſiſts in its being leſs than the values immediately preceding, and alſo leſs than the values immediately following it.

In ſome caſes a function may increaſe to a certain limit and then decreaſe, and afterwards increaſe again indefinitely; or the contrary. Hence it may happen that ſuch a function may have values greater than its *maximum* or leſs than its *minimum* as they have been here defined. And indeed it is eaſy to conceive that a function may increaſe and decreaſe alternately ſeveral times; in ſuch a caſe it muſt be conſidered as having ſeveral *maxima* and *minima*.

79. Since y any function of a variable quantity x may be conſidered as the ordinate of a curve, of which x is the abſciſſa, it is evident that to determine the greateſt or leaſt value of ſuch a function, we have only to ſeek the greateſt or leaſt ordinate of the curve which is the locus of the equation expreſſing the relation between x and y. Let us ſuppoſe this curve to be DPE, and that AB is the value of x, correſponding to BP the *maximum* or *minimum* value of the ordinate y; it is evident, that in the caſe of a *maximum*, the curve muſt be concave towards AC, at leaſt to a certain extent, on each ſide of the point P, as in fig. 12, but that in the caſe of a *minimum* it muſt be convex towards AC, as in fig. 13; and alſo, that in either caſe, if a ſtraight line be drawn through P parallel to AC, the curve muſt be wholly on one ſide of that line, to a certain extent on each ſide of the point P, and therefore, that the line PQ muſt be a tangent to the curve at the point P.

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Now when PQ a tangent to a curve at P (fig. 8) meets the axis in T, it has been ſhewn, § 75, that $\frac{\dot{y}}{\dot{x}}$ is the expreſſion for the tangent of the angle T, radius being unity; but this angle vaniſhes, when PQ, inſtead of meeting AC, is parallel to it, as in fig. 12, and fig. 13; therefore, as in this caſe the tangent of the angle is $= 0$, we have $\frac{\dot{y}}{\dot{x}} = 0$.

Hence it appears, that to determine the maximum *or* minimum *of* y, *a function of* x, *we muſt find the fluxion of the function, and divide it by* $\dot{x}$, *and put the reſult equal to* 0.

80. We proceed to illuſtrate this rule by ſome examples.

Ex. 1. To divide a given number a into two ſuch parts, that their product may be the greateſt poſſible.

Let x denote the one part, then $a - x$ will be the other part, and $x(a-x)$ the product of the two parts. Therefore, by the queſtion

$$y = x(a-x) = ax - x^2, \text{ a } \textit{maximum},$$

hence, taking the fluxion of the function,

$$\dot{y} = a\dot{x} - 2x\dot{x}, \text{ and } \frac{\dot{y}}{\dot{x}} = a - 2x,$$

therefore, $a - 2x = 0$, and $x = \frac{1}{2}a$.

Thus it appears that the product of the parts will be the greateſt poſſible, when each is half the given number.

Ex. 2. To find the fraction which ſhall exceed its cube by the greateſt quantity poſſible.

Let x denote the fraction, then its cube is x^3, ſo that we have

$$y = x - x^3, \text{ a } \textit{maximum};$$

therefore, taking the fluxion of the function,

$$\dot{y} = \dot{x} - 3x^2\dot{x}, \text{ and } \frac{\dot{y}}{\dot{x}} = 1 - 3x^2 = 0,$$

hence $3x^2 = 1$, and $x = \sqrt{\frac{1}{3}}$, the fraction required,

Ex. 3. To determine the greateſt rectangle that can be inſcribed in a given triangle.

Put the baſe A C of the triangle $= b$, and its altitude B D $= a$, and let B n, the altitude of the rectangle $p\,q\,r\,s$, conſidered as variable, be denoted by x, then, becauſe Fig. 14.

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because of the parallel lines A C, $p\,q$, it will be, as B D : A C : : D n : $p\,q$, that is $a : b . : a - x : p\,q$, hence $p\,q = \frac{b(a-x)}{a}$, and the area of the rectangle, or $p\,q \times$ B n, will be $= \frac{b(a-x)x}{a}$, therefore $y = \frac{b(a-x)x}{a}$ must be a *maximum*, and hence $\dot{y} = \frac{ba\dot{x} - 2bx\dot{x}}{a}$: thus we have,

$$\frac{\dot{y}}{\dot{x}} = \frac{ba - 2bx}{a} = 0,$$

and $ba - 2bx = 0$, and $x = \frac{1}{2}a$; hence it appears that the greatest inscribed rectangle is that whose altitude is half the altitude of the triangle.

81. It is proper to observe that the value of a quantity when a *maximum* or *minimum* may often be determined more readily by considering that any given multiple, or part of the function, likewise any power or root of it, must then be also a *maximum* or *minimum*. Thus in the preceding example, in which the function to be a *maximum* is $\frac{b(a-x)x}{a}$, we may reject the constant multiplier $\frac{b}{a}$, and then the function to be a maximum is $y = (a-x)x = ax - x^2$, the fluxion of which being taken, we have $\dot{y} = a\dot{x} - 2x\dot{x}$ and $\frac{\dot{y}}{\dot{x}} = a - 2x = 0$, hence $x = \frac{1}{2}a$, the same value as before.

82. *Ex.* 4. Of all the right-angled plane triangles having the same given hypothenuse, to find that whose area is greatest.

Fig. 15. Let A B C be the triangle; put A B $= x$, and A C, the given hypothenuse, $= a$, then B C $= \sqrt{(a^2 - x^2)}$, and consequently the area of the triangle is $\frac{x}{2}\sqrt{(a^2 - x^2)}$, which being a *maximum*, its square $\frac{x^2(a^2 - x^2)}{4}$, also four times that square, or $x^2(a^2 - x^2)$, will likewise be a *maximum*, therefore, $y = x^2(a^2 - x^2) = a^2x^2 - x^4$, a *max.* hence $\dot{y} = 2a^2x\dot{x} - 4x^3\dot{x}$, and

$$\frac{\dot{y}}{\dot{x}} = 2a^2x - 4x^3 = 0,$$

hence $2x^2 = a^2$, and $x = a\sqrt{\frac{1}{2}}$.

Ex. 5. To determine the greatest cylinder that can be inscribed in a given cone.

Fig. 16. Put A C the base of the cone $= b$, B H its altitude $= a$, and D F, the diameter of the end of the cylinder DIGF inscribed in the cone, $= x$. From the similar triangles BAC, BDF, we have AC : BH :: DF : BE, that is $b : a :: x$: BE, hence BE $= \frac{ax}{b}$, and EH $=$ BH $-$ BE $= a - \frac{ax}{b} = \frac{ab - ax}{b}$. Put c for the number .78539, then the area of the base of the cylinder is (by the Elements of Geometry) $c \times DF^2$, and its solid content $c \times DF^2 \times EH = \frac{cax^2(b-x)}{b}$, hence $\frac{cax^2(b-x)}{b}$ is to be a *maximum*, therefore, leaving out the constant multiplier $\frac{ca}{b}$, we have $y = x^2(b-x) = bx^2 - x^3$, a *maximum*; taking now the fluxions, we get

$$\dot{y} = 2bx\dot{x} - 3x^2\dot{x}, \text{ and } \frac{\dot{y}}{\dot{x}} = 2bx - 3x^2 = 0,$$

hence $3x^2 = 2bx$, and $x = \frac{2}{3}b$, and consequently HE $= \frac{1}{3}$BH.

Ex. 6. To find the sun's place in the ecliptic, when that part of the equation of time which arises from the obliquity of the ecliptic is a *maximum*.

Let EQ be the equator, EC the ecliptic, S the sun's place, and SA his declination, then this part of the equation of time is the difference of the sun's longitude ES, and right ascension EA, turned into time. Put the arch ES $= x$, the arch EA $= v$, which is to be considered as a function of x, and put a for the cosine of the angle E $= 23° 28'$. Then, by Spherical Trigonometry, in the right-angled spherical triangle EAS, we have tan. EA $=$ cos. E $\times$ tan. ES; therefore, to determine x we have tan. $v = a$ tan. x, and $y = x - v$, a *maximum*. Fig 17.

From the second of these equations we get

$$\dot{y} = \dot{x} - \dot{v}, \text{ and } \frac{\dot{y}}{\dot{x}} = 1 - \frac{\dot{v}}{\dot{x}} = 0,$$

and from the first, by § 60,

$$\dot{v}\,\text{sec.}^2 v = a\dot{x}\,\text{sec.}^2 x, \text{ and } \frac{\dot{v}}{\dot{x}} = \frac{a\,\text{sec.}^2 x}{\text{sec.}^2 v},$$

therefore, $1 - \frac{a\,\text{sec.}^2 x}{\text{sec.}^2 v} = 0$, and $\text{sec.}^2 v = a\,\text{sec.}^2 x$,

or $1 + \text{tan.}^2 v = a + a\,\text{tan.}^2 x$, but from the first equation $\text{tan.}^2 v = a^2\,\text{tan.}^2 x$, therefore,

$$1 + a^2\,\text{tan.}^2 x = a + a\,\text{tan.}^2 x,$$

$$\text{or } a(a-1)\,\text{tan.}^2 x = a - 1,$$

hence tan. $x = \sqrt{\frac{1}{a}} = 1.04416$, the tangent of $46° 14'$, the sun's longitude when this part of the equation is a *maximum*.

83. We have deduced the rule of § 79. for determining when a function is a maximum, or minimum, from the consideration of curve lines. The whole theory of *maxima* and *minima* may however be explained in a manner purely analytical, as follows:

Let us suppose that y is any function whatever of x, and that x has acquired the value that produces the *maximum* or *minimum* of the function; then, if we suppose $x - h$ and $x + h$ to be substituted successively in the function instead of x, the two resulting values ought to be both less than the maximum or both greater than the minimum value.

Let

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Let us denote the value of the function that results from the substitution of $x-h$ by y and that which results from the substitution of $x+h$ by y', then by the theorem given in § 69,

$$y=y-\frac{\dot{y}}{\dot{x}}h+\frac{\ddot{y}}{\dot{x}^2}\frac{h^2}{2}-\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2\,3}+\&c.$$

$$y'=y+\frac{\dot{y}}{\dot{x}}h+\frac{\ddot{y}}{\dot{x}^2}\frac{h^2}{2}+\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}+\&c.$$

In each of these values, $\frac{\dot{y}}{\dot{x}}$, the coefficient of h, must either be equal to some quantity, positive or negative, or else it must $=0$. Let us suppose, if possible, that it is equal to some quantity, positive or negative; now as h may be conceived to be so small that the term $\frac{\dot{y}}{\dot{x}}h$, or any other term, shall exceed the sum of all the terms that follow it in each series, (D) if we suppose h to have such a value, then, because of the term $\frac{\dot{y}}{\dot{x}}h$ having the sign $-$ in the one series, and $+$ in the other, it follows that the one value of the function is greater, and the other less than y, the *maximum* or *minimum* value: But this conclusion is inconsistent with the nature of a *maximum* or *minimum*, therefore $\frac{\dot{y}}{\dot{x}}$ cannot in the case of a maximum or minimum be equal to any positive or negative quantity whatever.

If however we assume $\frac{\dot{y}}{\dot{x}}=0$, so that the two values are,

$$y=y+\frac{\ddot{y}}{\dot{x}^2}\frac{h^2}{2}-\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}+\&c.$$

$$y'=y+\frac{\ddot{y}}{\dot{x}^2}\frac{h^2}{2}+\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}+\&c.$$

then as the second term $\frac{\ddot{y}}{\dot{x}^2}\frac{h^2}{2}$ has the same sign in both, when that term is greater than all the terms that follow it, we shall have both values greater than y when $\frac{\ddot{y}}{\dot{x}^2}$ is positive, and both less when it is negative, the first case corresponding to a *maximum*, and the second to a *minimum*.

Hence, to determine the *maximum* or *minimum* of the function y, it appears that we must take the fluxion of y, and divide it by $\dot{x}$, and put the result equal to 0, which agrees with what was shewn in § 79.

84. Although in the case of a function admitting of a *maximum* or *minimum* we have always $\frac{\dot{y}}{\dot{x}}=0$, yet we must not conclude that conversely the one or the other of these has place every time that $\frac{\dot{y}}{\dot{x}}=0$. For if it so happens that the value of x that renders $\frac{\dot{y}}{\dot{x}}=0$, causes also $\frac{\ddot{y}}{\dot{x}^2}$ to vanish, without at the same time making $\frac{\dddot{y}}{\dot{x}^3}$ to disappear, then we have

$$y=y-\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}+\frac{\ddddot{y}}{\dot{x}^4}\frac{h^4}{2.3.4}-\&c.$$

$$y'=y+\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}+\frac{\ddddot{y}}{\dot{x}^4}\frac{h^4}{2.3.4}+\&c.$$

and as by giving a proper value to h, $\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3}$ may be rendered greater than the sum of all the following terms in each series, it follows, that $\frac{\dddot{y}}{\dot{x}^3}$ being supposed to be any quantity either positive or negative, because of its sign being different in the two values, the one of them will be greater, and the other less than y, the *maximum* or *minimum* value, which result is inconsistent with the nature of a maximum or minimum. If however $\frac{\dddot{y}}{\dot{x}^3}$ be assumed $=0$, then

$y=$

(D) If this should not appear sufficiently obvious, let

$$Ah+Bh^2+Ch^3+Dh^4+\&c.$$

be such a series, where A, B, C, D, &c. denote quantities either positive or negative, but which are independent of h. Then, writing the series thus,

$$h(A+Bh+Ch^2+Dh^3+\&c.)$$

it is obvious that if h be conceived to be continually diminished, and at last to become $=0$, the part

$$Bh+Ch^2+Dh^3+\&c.$$

will also become $=0$, therefore before it vanishes it will be less than A, or any other assignable quantity, therefore $Bh^2+Ch^3+Dh^4+\&c.$ may become less than Ah.

$$y=y+\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3.4}-\&c.$$

$$y'=y+\frac{\dddot{y}}{\dot{x}^3}\frac{h^3}{2.3.4}+\&c.$$

here again, the coefficient of the second term having in both values the same sign, the conditions of the maximum or minimum are fulfilled, and the sign of $\frac{\dddot{y}}{\dot{x}^3}$ shews when the one or the other is to have place.

It must now be sufficiently evident, without proceeding any further, *that a function can only admit of a* maximum *or a* minimum *when the first of its fluxions that does not vanish, is of an even order* (*or is its second or fourth fluxion, &c.*), *and that the sign of that fluxion is negative in the case of a* maximum, *but positive in the case of a* minimum.

85. We shall conclude this theory by applying it to an example. Let y be such a function of x that

$$y^2-2mxy+x^2-a^2=0,$$

then by § 49,

$$(y-mx)\dot{y}-(my-x)\dot{x}=0,$$

and hence $\frac{\dot{y}}{\dot{x}}=\frac{my-x}{y-mx}=0$,

therefore $my-x=0$, and $y=\frac{x}{m}$.

To find the value of x, let this value of y be substituted in the original equation, it thus becomes

$$\frac{x^2}{m^2}-x^2-a^2=0,$$

hence we find

$$x=\frac{ma}{\sqrt{(1-m^2)}},\text{ and }y=\frac{a}{\sqrt{(1-m^2)}}.$$

We must now examine what is the nature of the expression for $\frac{\ddot{y}}{\dot{x}^2}$. Taking the fluxion of the equation $\frac{\dot{y}}{\dot{x}}=\frac{my-x}{y-mx}$, and considering that $\dot{x}$ is constant, we have

$$\frac{\ddot{y}}{\dot{x}}=\frac{(1-m^2)(\dot{x}\dot{y}-y\dot{x})}{(y-mx)^2},$$

therefore, dividing by $\dot{x}$,

$$\frac{\ddot{y}}{\dot{x}^2}=\frac{1-m^2}{(y-mx)^2}\left\{\frac{\dot{y}}{\dot{x}}x-y\right\},$$

but as in the present case $\frac{\dot{y}}{\dot{x}}=0$, and $y=\frac{x}{m}$, this expression becomes simply

$$\frac{\ddot{y}}{\dot{x}^2}=\frac{-m}{x(1-m^2)},$$

which equation, by putting instead of x its value $\frac{ma}{\sqrt{(1-m^2)}}$, becomes

$$\frac{\ddot{y}}{\dot{x}^2}=-\frac{1}{a\sqrt{(1-m^2)}},$$

and as this result is negative, we conclude that the value which we have found for y is a *maximum*.

Of the values of fractions, the numerators and denominators of which vanish at the same time.

86. There are some fractional functions of such a nature, that by giving a particular value to the variable quantity, both the numerator and denominator of the fraction vanish, and thus the fraction is reduced to this form $\frac{0}{0}$, an expression from which nothing can be concluded. We have an example of this in the fraction $\frac{x-a}{x^2-a^2}$, which, by supposing $x=a$ becomes $\frac{a-a}{a^2-a^2}=\frac{0}{0}$; we must not however conclude that the fraction has no determinate value in this particular case, for if we consider that its numerator and denominator have a common divisor, viz. $x-a$, it is evident that by taking this divisor out of both, the fraction $\frac{x-a}{x^2-a^2}=\frac{x-a}{(x-a)(x+a)}$, becomes $\frac{1}{x+a}$, an expression, which in the case of $x=a$ is equal to $\frac{1}{2a}$.

87. In general, if we make $x=a$ in an expression of this form $\frac{P(x-a)^m}{Q(x-a)^n}$, it becomes $\frac{0}{0}$; however its true value is either nothing, or finite, or infinite, according as $m>n$, or $m=n$, or $m<n$; for by taking out the factors common to the numerator and denominator, the fraction becomes $\frac{P(x-a)^{m-n}}{Q}$ in the first case, $\frac{P}{Q}$ in the second, and $\frac{P}{Q(x-a)^{n-m}}$ in the third; here we suppose that P and Q are such functions as neither become nothing, nor infinite, by the supposition of $x=a$.

88. Therefore, when by giving a particular value to x a function of that quantity assumes the form $\frac{0}{0}$, to discover the true value of the function in this particular case, we must disengage the factors which are common to the numerator and denominator. This may be done in most cases by finding their common measure (Algebra, § 49.) but the direct method of fluxions furnishes us with another method.

In the expression $P(x-a)$, where P denotes any function of x that is independent of $x-a$, if we suppose $x=a$, then the expression vanishes; the fluxion however of the expression, viz. $(x-a)\dot{P}+P\dot{x}$, is a quantity which does not vanish when $x=a$, but is then reduced to its last term, that is to $P\dot{x}$.

Direct Method.

Again, the function $P(x-a)^3$ vaniſhes by ſuppoſing $x=a$, but if we take its fluxion, viz. $(x-a)^3\dot{P}+2(x-a)P\dot{x}$, and again the fluxion of this quantity we get

$$(x-a)^2\ddot{P}+4(x-a)\dot{P}\dot{x}+1\cdot2\,P\dot{x}^2,$$

an expreſſion which does not vaniſh upon the hypotheſis of $x=a$, but is reduced to its laſt term. viz. $1\cdot2\,P\dot{x}^2$. By proceeding in this manner, it is eaſy to ſee that by taking the fluxion of a function of the form $P(x-a)^m$ m times ſucceſſively (m being a whole number) we ſhall finally obtain an expreſſion, all the terms of which, except the laſt, vaniſh by ſuppoſing that $x=a$; and that the laſt term will be $1\cdot2\cdot3\ldots m\,P\dot{x}^m$, an expreſſion free from the factor $(x-a)^m$, and involving only the function P.

89. It is not neceſſary that we ſhould know the number n, nor that we ſhould exhibit the factor $(x-a)^n$, in order to determine when the expreſſion $P(x-a)^n$ is freed from that factor. We have only to aſcertain after each operation of taking the fluxion, whether the reſult vaniſhes or not, when we ſubſtitute a inſtead of x; for in the laſt caſe the operation is finiſhed, and the reſult is the quantity $1\cdot2\cdot3\ldots P\dot{x}^m$. Suppoſe for example the function to be $x^3-ax^2-a^2x+a^3$, which vaniſhes when $x=a$, its firſt fluxion alſo vaniſhes when $x=a$, but not its ſecond fluxion, which is $(6x-2a)\dot{x}^2$, hence we may conclude that the function has the form $P(x-a)^2$, which is beſides obvious, becauſe

$$x^3-ax^2-a^2x+a^3=(x+a)(x-a)^2.$$

90. In applying theſe obſervations to the fraction $\frac{P(x-a)^m}{Q(x-a)^n}$, it appears, that by repeating the operation of taking the fluxions of its numerator and denominator, they will be freed at once from the factor $x-a$, if $m=n$. If a reſult, which does not vaniſh, be obtained firſt from the numerator, then we may be aſſured, that the factor $(x-a)$ is found in the numerator raiſed to a leſs power than in the denominator, and in this caſe the fraction is infinite when $x=a$. If on the contrary the firſt reſult that does not vaniſh is found from the denominator, then the numerator contains a higher power of $(x-a)$ than the denominator, and in this caſe, when $x=a$, the fraction vaniſhes.

The rule for finding the value of a function which becomes $\frac{0}{0}$ by giving a particular value to x may therefore be expreſſed thus. *Take the ſucceſſive fluxions of both the numerator and denominator until a reſult which does not vaniſh be obtained from either the one or the other, or from both at the ſame time; in the firſt caſe the function is infinite, in the ſecond it is equal to* 0, *and in the laſt caſe its value is finite.*

91. We proceed to illuſtrate this rule by a few examples.

Ex. 1. The value of the function $\frac{x^3-1}{x^2-1}$ is required when $x=1$.

The fluxion of the numerator is $3x^2\dot{x}$, and that of the denominator is $2x\dot{x}$, neither of which quantities vaniſh when $x=1$, therefore in this particular caſe, the value of the fraction is $\frac{3x^2}{2x}=\frac{3}{2}$.

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Ex. 2. Suppoſe the fraction to be $\frac{ax^2-2acx+ac^2}{bx^2-2bcx+bc^2}$, which vaniſhes when $x=c$.

By taking the fluxions of the numerator and denominator we obtain $\frac{2ax\dot{x}-2ac\dot{x}}{2bx\dot{x}-2bc\dot{x}}=\frac{ax-ac}{bx-bc}$, a fraction, the numerator and denominator of which ſtill vaniſh upon the hypotheſis of $x=c$, we therefore take the fluxions a ſecond time, and get $\frac{2a\dot{x}^2}{2b\dot{x}^2}=\frac{a}{b}$ for the value of the propoſed fraction in the particular caſe of $x=c$.

Ex. 3. Suppoſe the fraction to be

$$\frac{x^3-ax^2+a^2x-a^3}{x^3-a^2}$$

which vaniſhes when $x=a$. In this example, by taking the fluxions of the numerator and denominator once, we get

$$\frac{3x^2\dot{x}-2ax\dot{x}-a^2\dot{x}}{2x\dot{x}}=\frac{3x^2-2ax-a^2}{2x},$$

an expreſſion, of which only the numerator vaniſhes upon the ſuppoſition of $x=a$, hence we may conclude the true value of the fraction in this caſe to be 0.

The contrary happens in the fraction

$$\frac{ax-x^2}{a^4-2a^3x+2ax^3-x^4};$$

we may therefore conclude that when $x=a$ this laſt fraction becomes infinite.

92. The rule of § 90 can only be applied when the factors common to the numerator and denominator are integer powers of $x-a$, for as by taking the fluxions, the index of $(x-a)^m$ is diminiſhed by an unit at each operation; when m is a fraction we ſhall at laſt arrive at a reſult containing negative powers of $x-a$, which therefore, when $x=a$, will become infinite. The following mode of proceeding will however apply to all caſes whatever.

Let $\frac{X}{X'}$ be a fraction of which the numerator and denominator both vaniſh when $x=a$; by ſubſtituting in it $a+h$ inſtead of x, the functions X and X′ may be expanded into a ſeries of this form,

$$Ah^\alpha+Bh^\beta+\&c. \qquad A'h^{\alpha'}+Bh^{\beta'}+\&c.$$

which are *aſcending*, that is, having the exponents of the powers poſitive and increaſing; becauſe the ſerics muſt become 0, upon the hypotheſis that $h=0$. We have therefore

$$\frac{Ah^\alpha+Bh^\beta+\&c.}{A'h^{\alpha'}+B'h^{\beta'}+\&c.}$$

inſtead of the propoſed fraction.

Now

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Now if $\alpha > \alpha'$, by dividing the numerator and denominator of this expreſſion by the factor $h^{\alpha'}$, which is common to all the terms of each, it becomes

$$\frac{A h^{\alpha-\alpha'} + B h^{\beta-\alpha'} + \&c.}{A' + B h^{\beta'-\alpha'} + \&c.},$$

a quantity which, by ſuppoſing $h=0$, is reduced to $\frac{0}{A'}$, that is to 0. If again $\alpha=\alpha'$, the expreſſion for the fraction, after dividing the numerator and denominator by h^{α}, is

$$\frac{A + B h^{\beta-\alpha'} + \&c.}{A' + B h^{\beta'-\alpha'} + \&c.}$$

which, by ſuppoſing h to be $=0$, becomes ſimply $\frac{A}{A'}$, a finite quantity. If, however, $\alpha < \alpha'$, then the expreſſion for the fraction is

$$\frac{A + B h^{\beta-\alpha} + \&c.}{A h^{\alpha'-\alpha} + B h^{\beta'-\alpha} + \&c.},$$

which, when $h=0$, becomes $\frac{A}{0}$, an expreſſion which may be conſidered as infinite. Thus it appears that in each caſe the true value of the fraction depends only on A and A', the firſt terms of the ſeries.

The following rule is applicable to every function that can appear under the indeterminate form $\frac{0}{0}$.

Find the firſt term of each of the aſcending ſeries which expreſs the developements of the numerator and denominator when a+h *is ſubſtituted in them inſtead of* x. *Reduce the new function formed of theſe firſt terms to its moſt ſimple form, and make* h=0; *the reſults ſhall be the different values of the propoſed function when* x *is made equal to* a.

Example. Suppoſe the function to be

$$\frac{\sqrt{x} - \sqrt{a} + \sqrt{(x-a)}}{\sqrt{(x^2-a^2)}},$$

which, when $x=a$, becomes $\frac{0}{0}$. By ſubſtituting $a+h$ inſtead of x, and developing the reſults into ſeries, the numerator becomes $h^{\frac{1}{2}} + \frac{h}{2\sqrt{a}} + \&c.$ and the denominator $\sqrt{2a}\,h^{\frac{1}{2}} + \frac{h^{\frac{1}{2}}}{2\sqrt{2a}} + \&c.$ Taking now the firſt term of each ſeries, we have $\frac{h^{\frac{1}{2}}}{2\sqrt{2a}\,h^{\frac{1}{2}}} = \frac{1}{2\sqrt{2a}}$, an expreſſion in which h is not found; therefore the value of the function is $\frac{1}{\sqrt{2a}}$, when $x=a$.

Fig. 15.

Of the Radii of Curvature.

93. Let HC'CF repreſent a material curve, or mould. Let a thread be faſtened to it at H, and made to paſs along the curve, ſo as to coincide with it in its whole extent from H to F. Let the thread be now unlapped or *evolved* from the curve, then its extremity F will deſcribe another curve line FAPP'. The curve HCF is called the EVOLUTE of the curve FAP; and the curve FAP is called the INVOLUTE of the curve HCF.

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94. From this mode of conceiving the curve to be generated, we may draw the following concluſions.

1ſt. Suppoſe PC to be a portion of the thread detached from the evolute, then PC will be a tangent to the evolute at C.

2dly. The line PC will be perpendicular to a tangent to the curve FAP at the point P, or will be a normal to the curve at that point. For the point P may be conſidered as deſcribing at the ſame time an element of the curve FAP, and an element of a circle $q\,P\,q'$ whoſe momentary centre is C, and which has PC for its radius.

3dly. That part of the curve between F and P, which is deſcribed with radii all of which are ſhorter than CP is more incurvated than a circle deſcribed on P as a centre, with a radius equal to CP. And in like manner PP', the part of the curve on the other ſide of P, which is deſcribed with radii greater than PC, is leſs incurvated than that circle.

4thly. The circle $q\,P\,q'$ has the ſame curvature as the curve APP' itſelf has at P: hence it is called an EQUICURVE circle, and its radius PC is called the RADIUS of CURVATURE at the point C.

95. We are now to inveſtigate how the radius of curvature at any point in FAP any propoſed curve may be found.

Let AB and BP be the co-ordinates at P any point in the curve, and PC its radius of curvature; and let PC meet AB in E. Put the abſciſſa AB=x, the ordinate BP=y, the arch AP=z, the angle AEP (that is, the arch which meaſures that angle, radius being unity) =v, the radius of curvature PC=r. Take P' another point in the curve, and let P'C' be the radius of curvature at that point. Let P'C' meet AB in E', and PC in D, and on D as a centre, with a radius =1, deſcribe an arch of a circle, meeting the radii PC, P'C' in m and n. Then the arch PP' will be the increment of z; and ſince the angle PDP' is the difference of the angles PEA, P'E'A, the arch $m\,n$ will be the correſponding increment of v.

Suppoſe now the point P' to approach continually to P, then the points C' and D will approach to C, and the ratio of the arch PP', the increment of z, to the arch $m\,n$ the increment of v, will approach to the ratio of CP to Cm, that is to the ratio of r to 1; therefore the ratio of r to 1 is the limit of the ratio of PP' to $m\,n$, or r= limit of $\frac{PP'}{m\,n}$, and paſſing to the ratio of the fluxions, $r=\frac{\dot{z}}{\dot{v}}$, thus we have obtained a formula expreſſing the radius of curvature, by means of the fluxion of the arch of the curve, and the fluxion of the angle which a normal to the curve makes with the line of the abſciſſas. We proceed to deduce from this formula

other expreſſions which may involve the fluxions of x and y only.

96. Becauſe PE is a normal to the curve at E, the tangent of the angle PEA or v is equal to $\frac{\dot{x}}{\dot{y}}$ (§ 75.), put $\frac{\dot{x}}{\dot{y}}=t$, then becauſe tan. $v=t$, we have by taking the fluxions (§ 60.), $\dot{v}$ ſec.^{2} $v=\dot{t}$, but ſec.$^2 v=1+$tan.$^2 v$ $=1+\frac{\dot{x}^2}{\dot{y}^2}=\frac{\dot{x}^2+\dot{y}^2}{\dot{y}^2}=\frac{\dot{z}^2}{\dot{y}^2}$ (§ 63.), therefore $\frac{\dot{v}\,\dot{z}^2}{\dot{y}^2}=\dot{t}$ and $\dot{v}=\frac{\dot{t}\,\dot{y}^2}{\dot{z}^2}$.

Subſtituting now this value of $\dot{v}$ in the formula $r=\frac{\dot{z}}{\dot{v}}$ it becomes $r=\frac{\dot{z}^3}{\dot{t}\,\dot{y}^2}$.

If we now recollect that $t=\frac{\dot{x}}{\dot{y}}$, and that $\dot{z}^2=\dot{x}^2+\dot{y}^2$, it will appear that this other expreſſion which we have found for r involves in effect the fluxions of x and y only.

97. In computing the values of $t=\frac{\dot{x}}{\dot{y}}$, and $\frac{\dot{z}^3}{\dot{t}\,\dot{y}^2}$ we may conſider any two of the three quantities x, y, z, as a function of the remaining quantity; and upon that hypotheſis compute their fluxions.

Thus if we ſuppoſe that y and z are functions of x, then, as in taking the fluxions of y, t, and z, we muſt conſider $\dot{x}$ as a given or conſtant quantity, from the equation $t=\frac{\dot{x}}{\dot{y}}$ we have $\dot{t}=-\frac{\dot{x}\,\ddot{y}}{\dot{y}^2}$ (§ 39.), and ſubſtituting this value of $\dot{t}$ in $\frac{\dot{z}^3}{\dot{t}\,\dot{y}^2}$, the value laſt found for r, it becomes

$$r=\frac{\dot{z}^3}{-\dot{x}\,\ddot{y}}=\frac{(\dot{x}^2+\dot{y}^2)^{\frac{3}{2}}}{-\dot{x}\,\ddot{y}}.$$

If again, inſtead of conſidering y and z as functions of x, we conſider x and z as functions of y, then from the equation $t=\frac{\dot{x}}{\dot{y}}$ (as $\dot{y}$ muſt now be reckoned conſtant), we get $\dot{t}=\frac{\dot{x}}{\dot{y}}$, thus the formula $r=\frac{\dot{z}^3}{\dot{t}\,\dot{y}^2}$ becomes

$$r=\frac{\dot{z}^3}{\ddot{x}\,\dot{y}}=\frac{(\dot{x}^2+\dot{y}^2)^{\frac{3}{2}}}{\ddot{x}\,\dot{y}}.$$

We ſhall now apply theſe formulæ to ſome examples.

98. *Example* 1.—It is required to find the general expreſſion for the radius of curvature of a parabola.

The equation of the parabola is $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$, therefore, $\dot{y}=\frac{1}{2}a^{\frac{1}{2}}\dot{x}x^{-\frac{1}{2}}=\frac{a^{\frac{1}{2}}\dot{x}}{2x^{\frac{1}{2}}}$, and, making $\dot{x}$ conſtant, $\ddot{y}=-\frac{1}{4}a^{\frac{1}{2}}\dot{x}^2x^{-\frac{3}{2}}=\frac{-a^{\frac{1}{2}}\dot{x}^2}{4x^{\frac{3}{2}}}$, therefore, $\dot{z}=\sqrt{(\dot{x}^2+\dot{y}^2)}$ $\frac{\dot{x}}{2}\sqrt{\left(\frac{4x+a}{x}\right)}$, and, putting r for the radius of curvature,

$$r=\frac{\dot{z}^3}{-\dot{x}\,\ddot{y}}=\frac{(a+4x)^{\frac{3}{2}}}{2\sqrt{a}}.$$

If in this general expreſſion, we put $x=0$, we find $\frac{a^{\frac{3}{2}}}{2\sqrt{a}}=\frac{1}{2}a$ for the radius of curvature at the vertex of the curve.

Ex. 2. Suppoſe the curve to be an ellipſe, required as in the laſt example.

Putting a and c to denote the two axes, the equation of the ellipſe is $a^2y^2=c^2(ax-x^2)$. Hence taking the firſt and ſecond fluxions, we have $2a^2y\dot{y}=c^2\dot{x}(a-2x)$, and $2a^2\dot{y}^2+2a^2y\ddot{y}=-2c^2\dot{x}^2$; whence $\dot{y}=\frac{c^2\dot{x}(a-2x)}{2a^2y}$, and $-\ddot{y}=\frac{a^2\dot{y}^2+c^2\dot{x}^2}{a^2y}$, which expreſſions, by ſubſtituting the values of y and $\dot{y}$ become

$$\dot{y}=\frac{c\dot{x}(a-2x)}{2a\sqrt{(ax-x^2)}}$$

$$-\ddot{y}=\left\{\begin{array}{l}\frac{a^2c^2\dot{x}^2(a-2x)^2}{4a^3c(ax-x^2)\sqrt{(ax-x^2)}}\\ +\frac{c\dot{x}^2}{a\sqrt{(ax-x^2)}}\end{array}\right.$$

$$=\frac{c\dot{x}^2}{a}\times\frac{(a-2x)^2+4(ax-x^2)}{4(ax-x^2)\sqrt{(ax-x^2)}}$$

$$=\frac{ca\dot{x}^2}{4(ax-x^2)^{\frac{3}{2}}};$$

therefore,

$$\dot{z}=\sqrt{(\dot{x}^2+\dot{y}^2)}$$

$$=\sqrt{\left(\frac{c^2\dot{x}^2(a-2x)^2}{4a^2(ax-x^2)}+\dot{x}^2\right)}$$

$$=\frac{\dot{x}}{2a}\sqrt{\left(\frac{c^2a^2+(a^2-c^2)(4ax-4x^2)}{ax-x^2}\right)}$$

and

$$r=\frac{\dot{z}^3}{-\dot{x}\,\ddot{y}}$$

$$=\frac{(a^2c^2+4(a^2-c^2)(ax-x^2)^{\frac{3}{2}}}{2a^3c};$$

which expreſſion, when $x=o$, becomes ſimply $\frac{c^2}{2a}$, the radius of curvature at the vertices of the tranſverſe axis; but when $x=\frac{1}{2}a$, it becomes $\frac{a^2}{2c}$, the radius of curvature at the vertices of the conjugate axis.

PART

PART II. THE INVERSE METHOD OF FLUXIONS.

99. AS the DIRECT METHOD of fluxions treats of finding the relation between the fluxions of variable quantities, having given the relation subsisting between the quantities themselves; so the INVERSE METHOD treats of finding the relation subsisting between the variable quantities, having given the relation of their fluxions.

Whatever be the relation between variable quantities, we can in every case assign the relation of their fluxions; therefore the direct method of fluxions may in this respect be considered as perfect. But it is not the same with the inverse method, for there are no direct and general rules, by which we can in every case determine from the relation of the fluxions, that of their flowing quantities or fluents. All we can do is to compare any proposed fluxion with such fluxions as are derived from known fluents by the rules of the direct method, and if we find it to have the same form as one of these, we may conclude that the fluents of both, or at least the variable parts of these fluents, are identical.

100. In the direct method we have shewn, that by proper transformations, the finding of the fluxion of any proposed function is reducible to the finding of the fluxions of a few simple functions, and of the sums, or products, or quotients of such functions. In like manner, in the inverse method we must endeavour to transform complex fluxionary expressions into others more simple, so as to reduce them, if possible, to some fluxion, the fluent of which we already know.

SECT. I. *Of the Fluents of Fluxions involving one variable quantity.*

101. As when y is such a function of a variable quantity x, that $y=\mathrm{A}\,x^m+\mathrm{C}$, where A, m and C denote constant quantities, we find by the direct method (§ 36. and § 26.) that $\dot{y}=m\,\mathrm{A}\,x^{m-1}\dot{x}$, or (putting a instead of m A, and n instead of $m-1$), $\dot{y}=a\,x^n\,\dot{x}$; so on the contrary, as often as we have the fluxional equation

$$\dot{y}=a\,x^n\,\dot{x},$$

we may conclude that the relation of the fluents is expressed by the equation

$$y=\frac{a\,x^{n+1}}{n+1}+\mathrm{C};$$

for by substituting m A instead of a, and $m-1$ instead of n in this equation, it becomes $y=\mathrm{A}\,x^m+\mathrm{C}$, the same equation as that from which the fluxional equation was derived.

102. The value of the constant quantity C, which is generally called by writers on fluxions, the *correction* of the fluent, is to be determined from the particular inquiry in which the fluxional equation $\dot{y}=a\,x^n\,\dot{x}$ occurs. If it be known that $y=0$, when x acquires some known magnitude, which may be denoted by b, then the general equation $y=\frac{a\,x^{n+1}}{n+1}+\mathrm{C}$, becomes in that particular case

$$0=\frac{a\,b^{n+1}}{n+1}+\mathrm{C};$$

Hence, by subtracting each side of this last equation from the corresponding side of the former, we get

$$y=\frac{a\,(x^{n+1}-b^{1+n})}{n+1}$$

an equation that is independent of the constant and arbitrary quantity C.

103. By giving particular values to n in the fluxional equation $\dot{y}=a\,x^n\,\dot{x}$, and in that of the fluents $y=\frac{a\,(x^{n+1}-b^{n+1})}{n+1}$, we may obtain particular fluxional equations, and corresponding equations of the fluents. There is, however, one case which requires to be noticed; it is when n is $=-1$; then the equation of the fluxions is $\dot{y}=a\,x^{-1}\dot{x}=\frac{a\,\dot{x}}{x}$, and that of the fluents, according to the general formula $y=\frac{a(x^{-1+1}-b^{-1+1})}{-1+1}$ $=\frac{a(x^0-b^0)}{0}$, $=\frac{a(1-1)}{0}=\frac{0}{0}$, but from this expression it is manifest, that nothing can be concluded. The value of the function $\frac{a\,(x^{n+1}-b^{n+1})}{n+1}$, in the particular case of $n+1=0$ may be found by the rule given in § 90 for determining the value of a function when it assumes the form $\frac{0}{0}$; but it may be otherwise found by proceeding thus. Put $n+1=m$, and let $p=\frac{\log.\,x}{\log.\,e}$, and $q=\frac{\log.\,b}{\log.\,e}$; then, by the formula of § 54,

$$x^m=1+p\,m+\frac{p^2\,m^2}{2}+\ \&c.$$

$$b^m=1+q\,m+\frac{q^2\,m^2}{2}+\ \&c.$$

and therefore

$$x^m-b^m=(p-q)\,m+(p^2-q^2)\frac{m^2}{2}+\ \&c.$$

$$\text{and}\ \frac{x^m-b^m}{m}=(p-q)+(p^2-q^2)\frac{m}{2}+\ \&c.$$

Thus

Thus we have $\frac{x^m-b^m}{m}$, or $\frac{x^{n+1}-b^{n+1}}{n+1}$ expreſſed generally by a ſeries, all the terms of which, except the firſt, being multiplied by m or $n+1$, will vaniſh when $n+1=0$, or when $n=-1$, hence it appears, that the general equation $y=\frac{a\,(x^{n+1}-b^{n+1})}{n+1}$, becomes in the particular caſe of $n=-1$, $y=a\,(p-q)$, which, ſubſtituting for p and q their values, and obſerving that

$$\frac{\log.\,x}{\log.\,e}-\frac{\log.\,b}{\log.\,e}=\frac{1}{\log.\,e}\times\log.\,\frac{x}{b},\text{ becomes}$$

$$y=\frac{a}{\log.\,e}\times\log.\frac{x}{b}$$

where log. e, and log. $\frac{x}{b}$ are to be taken according to the ſame ſyſtem, which may be any ſyſtem of logarithms whatever. So that if we take the Napierean ſyſtem, in which log. $e=1$, then

$$y=a\,\text{l.}\frac{x}{b}=a\,\text{l.}\,x-a\,\text{l.}\,b=a\,\text{l.}\,x+\text{C},$$

where C denotes a conſtant quantity, and where the letter l, in this formula, and in others in which it may occur, is put as an abbreviation of the words *Napierean logarithm*, ſo that by $a\,\text{l.}\,x$ is meant a multiplied by the Napierean logarithm of x, &c.

This expreſſion which we have found for the value of y in the particular caſe of $\dot{y}=ax^{-1}\dot{x}$, or $\frac{a\dot{x}}{x}$, coincides with what we might have found by conſidering that when $y=\text{l.}\,x$, it has been ſhewn (§ 57.) that $\dot{y}=\frac{\dot{x}}{x}$, ſo that converſely, when $\dot{y}=\frac{a\dot{x}}{x}$, we may conclude that $y=a\,\text{l.}\,x+\text{C}$ where C denotes a conſtant quantity, to be determined from the particular queſtion in which the fluxional equation may occur.

104. It muſt now be evident that if

$$\dot{y}=ax^m\dot{x}+bx^n\dot{x}+cx^p\dot{x}+\text{ &c.}$$

where m, n, p, &c. are conſtant numbers, then

$$y=\frac{ax^{m+1}}{m+1}+\frac{bx^{n+1}}{n+1}+\frac{cx^{p+1}}{p+1}+\text{ &c. }+\text{C};$$

here C denotes a conſtant arbitrary quantity that may be conſidered as the ſum of the conſtant quantities which ought to be added to the terms $\frac{ax^{m+1}}{m+1}$, $\frac{bx^{n+1}}{n+1}$, &c. each being regarded as a diſtinct fluent.

105. In general, ſince that when

$$y=at+bv+cu+\text{ &c. }+\text{C},$$

where t, v, u, &c. denote any functions of a variable quantity, and C a conſtant quantity, we have (§ 35. and § 36.)

$$\dot{y}=\dot{at}+\dot{bv}+\dot{cu}+\text{ &c.}$$

So on the contrary, if we have any fluxional equation of this laſt form, we may conclude that

$$y=at+bv+cu+\text{ &c. }+\text{C}.$$

And ſince that when $u=vt+\text{C}$, where u, v and t denote any function of a variable quantity, and C a conſtant quantity, we have § 37, $\dot{u}=v\dot{t}+t\dot{v}$, ſo on the contrary, if

$$\dot{u}=v\dot{t}+t\dot{v},$$

we may conclude that

$$u=vt+\text{C},$$

and in like manner if we have

$$\dot{u}=\frac{t\dot{v}-v\dot{t}}{t^2}=\frac{\dot{v}}{t}-\frac{v\dot{t}}{t^2},$$

we may infer from § 39. that

$$u=\frac{v}{t}+\text{C}.$$

106. It is often convenient to denote the fluent of a fluxional expreſſion without actually exhibiting that fluent. For this purpoſe we ſhall employ the ſign $\int$, putting it before the fluxion whoſe fluent we mean to denote. Thus, by the expreſſion $\int a\dot{x}^n\dot{x}$, is to be underſtood the fluent of $a\dot{x}^n\dot{x}$; and as this fluent has been found to be $\frac{a\dot{x}^{n+1}}{n+1}+\text{C}$, we may expreſs this concluſion in ſymbols ſhortly thus,

$$\int a\dot{x}^n\dot{x}=\frac{a\dot{x}^{n+1}}{n+1}+\text{C}.$$

107. Suppoſe we have $\dot{y}=(ax+b)^m\dot{x}$, we may expand $(ax+b)^m$ into a ſeries, and multiply the ſeries by $\dot{x}$, and find the fluent of each term of the reſult. But we may alſo find the fluent of this expreſſion without employing the developement of $(ax+b)^m$, by proceeding thus. Put $ax+b=z$, then $x=\frac{z-b}{a}$, and $\dot{x}=\frac{\dot{z}}{a}$. Subſtitute now theſe values of $ax+b$, and $\dot{x}$, in the expreſſion for $\dot{y}$, and it becomes $\dot{y}=\frac{z^m\dot{z}}{a}$; hence we have (§ 101.) $y=\frac{z^{m+1}}{a(m+1)}+\text{C}$, and conſequently, by ſubſtituting $(ax+b)$ for z,

$$y=\frac{(ax+b)^{m+1}}{a(m+1)}+\text{C}.$$

108. Suppoſe that $\dot{y}=(ax^n+b)^mx^{n-1}\dot{x}$. By putting as before $ax^n+b=z$, we have $nax^{n-1}\dot{x}=\dot{z}$, and $x^{n-1}\dot{x}=\frac{\dot{z}}{na}$; hence $\dot{y}=\frac{z^m\dot{z}}{na}$, and $y=\frac{z^{m+1}}{na(m+1)}+\text{C}$, and, ſubſtituting for z its value ax^n+b,

$y=$

$$y=\frac{(ax^n+b)^{m+1}}{na(m+1)}+C.$$

107. Let us now conſider fractional functions, and to begin with a ſimple caſe, let us ſuppoſe that $\dot{y}=\frac{Ax^m\dot{x}}{(ax+b)^n}$. Put $ax+b=z$, then $x=\frac{z-b}{a}$, $\dot{x}=\frac{\dot{z}}{a}$, and conſequently,

$$\dot{y}=\frac{A(z-b)^m\dot{z}}{a^{m+1}z^n};$$

We have now only to find the developement of $(z-b)^m$, to multiply each of its terms by $\dot{z}$ and divide it by z^n, and take the fluent of the reſult.

Let us take for example the caſe of $m=3$, and $n=2$, then

$$\dot{y}=\frac{A(z-b)^3\dot{z}}{a^4z^2}$$

$$=\frac{A}{a^4}\left\{z\dot{z}-3b\dot{z}+3b^2z^{-1}\dot{z}-b^3z^{-2}\dot{z}\right\}$$

Hence, taking the fluents of the ſeveral terms, as in § 105, we have

$$y=\frac{A}{a^4}\left\{\frac{z^2}{2}-3bz+3b^2\text{l}.z+b^3z^{-1}\right\}+C.$$

Let us now reſtore the value of z, and then it appears, that when

$$\dot{y}=\frac{Ax^3\dot{x}}{(ax+b)^2},$$

$$y=\frac{A}{a^4}\cdot\left\{\begin{matrix}\frac{1}{2}(ax+b)^2-3b(ax+b)\\+3b^2\text{l}.(ax+b)+b^3(ax+b)^{-1}\end{matrix}\right\}+C.$$

110. If we ſuppoſe that

$$\dot{y}=\frac{Ax^n\dot{x}+Bx^p\dot{x}+Cx^q\dot{x}+\&c.}{(a+bx)},$$

then, we may write the equation thus,

$$\dot{y}=\frac{Ax^n\dot{x}}{(a+bx)^m}+\frac{Bx^p\dot{x}}{(a+bx)^m}$$

$$+\frac{Cx^q\dot{x}}{(a+bx)^m}+\&c.$$

and take the fluent of each term, in the ſame manner as we have found the fluent of $\frac{Ax^3\dot{x}}{(ax+b)^2}$.

Of the Fluents of rational Fractions.

111. Every fluxion that is a rational fraction is comprehended under this general formula,

$$\frac{(Ax^m+Bx^n+Cx^p+\&c.)\dot{x}}{A'x^{m'}+B'x^{n'}+C'x^{p'}+\&c.},$$

which, by putting U to denote the expreſſion between the parentheſes in the numerator, and V the denominator, may be repreſented by $\frac{U\dot{x}}{V}$. Now in the firſt place, we remark that the greateſt exponent of the powers of x in the numerator may be ſuppoſed to be leſs than that of its powers in the denominator. For if it were not ſo, by dividing U by V, and calling Q the quotient, and R the remainder, we ſhould have $\frac{U\dot{x}}{V}=Q\dot{x}+\frac{R\dot{x}}{V}$, and

$$\int\frac{U\dot{x}}{V}=\int Q\dot{x}+\int\frac{R\dot{x}}{V}.$$

Now, Q being a rational and integer function, $\int Q\dot{x}$ may be found, as in § 101, and it only remains to find $\int\frac{R\dot{x}}{V}$, an expreſſion in which the higheſt exponent of the powers of x in R is leſs by unity than in V; ſo that the fraction $\frac{R\dot{x}}{V}$ may be generally expreſſed thus,

$$\frac{(Ax^{n-1}+Bx^{n-2}+Cx^{n-3}\ldots+T)\dot{x}}{x^n+A'x^{n-1}+B'x^{n-2}+C'x^{n-3}\ldots+T'}.$$

The general method of finding the fluent of a fractional expreſſion of this form conſiſts in decompoſing it into a ſeries of other fractions, the denominators of which are more ſimple. Theſe fractions may be found by proceeding as follows: By putting the denominator of the propoſed fraction equal to 0, we get this equation,

$$x^n+A'x^{n-1}+B'x^{n-2}\ldots+T'=0.$$

Suppoſe now that the roots of this equation are found, and that they are denoted by

$$-a,\ -a',\ -a'',\ -a''',\ \&c.$$

which quantities we ſhall ſuppoſe in the firſt place, are all unequal. Then the expreſſion which has been aſſumed as equal to 0, may (Algebra, Sect. X.) be conſidered as the product of n factors

$$x+a,\ x+a',\ x+a'',\ x+a''',\ \&c.$$

Let the propoſed fraction $\frac{R}{V}$ be now aſſumed as equal to the ſum of the ſimple fractions

$$\frac{N}{x+a},\ \frac{N'}{x+a'},\ \frac{N''}{x+a''},\ \&c.$$

having for their denominators the ſimple factors of the denominator of the propoſed fraction, and for their numerators quantities which are conſtant, but as yet are indetermined.

That we may avoid complicated calculations, and preſent a determinate object to the mind, let us ſuppoſe that the fluxion of which we are to find the fluent is

$$\frac{(Ax^2+Bx+C)\dot{x}}{x^3+A'x^2+B'x+C'},$$

and that we have by the reſolution of the cubic equation $x^3+A'x^2+B'x+C'=0$ found

$$x^3+A'x^2+B'x+C'=(x+a)(x+a')(x+a').$$

The

The fractions

$$\frac{N\dot{x}}{x+a}, \frac{N'\dot{x}}{x+a'}, \frac{N''\dot{x}}{x+a''},$$

when reduced to a common denominator are

$$\frac{N(x+a')(x+a'')\dot{x}}{(x+a)(x+a')(x+a'')}, \frac{N'(x+a)(x+a'')\dot{x}}{(x+a)(x+a')(x+a'')},$$
$$\frac{N''(x+a)(x+a')\dot{x}}{(x+a)(x+a')(x+a'')}.$$

The common denominator of these fractions is the same as that of the proposed fraction, and each of the numerators, as well as their sum, is a function of x of a degree lower than the denominator, that is, in the present case, it is a function of the second degree. By taking the actual products of the factors in the numerators, and adding the results, we find the sum of the fractions equal to

$$\frac{\dot{x}}{V}\left\{\begin{array}{l}(N+N'+N'')x^2\\ +\left\{N(a'+a'')+N'(a+a'')+N''(a+a')\right\}x\\ +Na'a''+N'aa''+N''aa'\end{array}\right\}$$

where V denotes the common denominator $(x+a)(x+a')(x+a'')=x^3+A'x^2+B'x+C'$. Setting aside the factor $\frac{\dot{x}}{V}$ of the above expression, we are now to compare that part of it which involves the three indeterminate quantities N, N', N'', with Ax^2+Bx+C, the numerator of the proposed fraction, thus we obtain these three equations

$$N+N'+N''=A,$$
$$N(a'+a'')+N'(a+a'')+N''(a+a')=B,$$
$$Na'a''+N'aa''+N''aa'=C.$$

By these equations, which are all of the first degree, we may determine the values of N, N' and N'', and thus we have the proposed fraction $\frac{(Ax^2+Bx+C)\dot{x}}{x^3+A'x^2+B'x+C'}$ equal to

$$\frac{N\dot{x}}{x+a}+\frac{N'\dot{x}}{x+a'}+\frac{N''\dot{x}}{x+a''},$$

where N, N', N'', and a, a', a'', are constant and known quantities.

Put $x+a=z$, then $\dot{x}=\dot{z}$, and the fraction $\frac{N\dot{x}}{x+a}$ is transformed to $\frac{N\dot{z}}{z}$, of which the fluent is $N\,l.\,z=N\,l.\,(x+a)$ (§ 103). In like manner we find $\int\frac{N'\dot{x}}{x+a'}=N'\,l.\,(x+a')$, and $\int\frac{N''\dot{x}}{x+a''}=N''\,l.\,(x+a'')$, and consequently

$$\int\frac{(Ax^2+Bx+C)\dot{x}}{x^3+A'x^2+B'x+C'}$$
$$=N\,l.(x+a)+N'l.(x+a')+N''l.(x+a'')+\textit{const.}$$
$$=l.\left\{(x+a)^N(x+a')^{N'}(x+a'')^{N''}\right\}+\textit{const.}$$

where by *const.* is meant a constant quantity.

It is easy to extend this mode of proceeding to the general formula given at the beginning of this §; and it is obvious, that as often as the denominator of a rational fraction can be decomposed into real and unequal factors, the determination of the fluent of that fraction is attended with no other difficulty than this decomposition, which requires the numerical resolution of equations.

112. We have supposed that the factors of the denominator of the proposed fraction are unequal among themselves, and it is only when this is the case that the fraction can be decomposed into others, having all this form $\frac{N}{x+a}$. If we suppose that the denominator $x^n+A'x^{n-1}+B'x^{n-2}\ldots+T'$ has a factor of the form $(x+a)^p$, then the proposed fraction

$$\frac{(Ax^{n-1}+Bx^{n-2}+Cx^{n-3}\ldots+T)\dot{x}}{x^n+A'x^{n-1}+B'x^{n-2}+C'x^{n-3}\ldots+T}$$

must be assumed equal to

$$\frac{(Px^{p-1}+Qx^{p-2}+Rx^{p-3}\ldots+Y)\dot{x}}{(x+a)^p}$$
$$+\frac{N'\dot{x}}{x+a'}+\frac{N''\dot{x}}{x+a''}\ldots.$$

where P, Q, R ... Y, N', N'', &c. denotes indeterminate but constant quantities, and $x+a'$, $x+a''$, &c. are the remaining factors of the denominator of the proposed fraction. To determine the quantities P, Q, R ... Y, N', N'', &c. we must now proceed in all respects as in last §, that is, we must reduce the fractions involving these quantities to a common denominator, which will be the same as the denominator of the proposed fraction; then we must add the numerators, and put the coefficient of each power of x in the sum equal to the coefficient of the same power in the numerator of the proposed fraction. Thus we shall have as many equations as indeterminate quantities, and by resolving these equations, the values of these quantities will be found.

Having thus determined all the quantities P, Q, R, ... Y, which enter into the fraction

$$\frac{(Px^{p-1}+Qx^{p-2}\ldots+Y)\dot{x}}{(x+a)^p}$$

its fluent may be found as shewn in § 109. But we may also assume it equal to

$$\frac{M\dot{x}}{(x+a)^p}+\frac{M'\dot{x}}{(x+a)^{p-1}}+\frac{M''\dot{x}}{(x+a)^{p-2}}$$
$$\ldots+\frac{M'''\ldots\dot{x}}{x+a},$$

and, it is easy to see, that by reducing these fractions to a

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a common denominator and adding them, the numerator of their ſum will have the ſame form as that of the fraction whoſe fluent we are ſeeking; ſo that the values of the indeterminate quantities M, M', &c. will be found by putting the coefficients of the ſame power of x in both numerators equal to each other. To find the fluent of $\frac{M\dot{x}}{(x+a)^p}$ we may aſſume $x+a=z$, then $\dot{x}=\dot{z}$, and

$$\int\frac{M\dot{x}}{(x+a)^p}=\int\frac{M\dot{z}}{z^p}=\frac{Mz^{-p+1}}{1-p}$$
$$=\frac{M}{(1-p)(x+a)^{p-1}}.$$

In like manner

$$\int\frac{M'\dot{x}}{(x+a)^{p-1}}=\frac{M'}{(2-p)(x+a)^{p-2}}$$

and ſo on, all the fluents being algebraic, except the laſt $\int\frac{M'''\ldots\dot{x}}{x+a}$ which is $M'''\cdots 1.(x+a)$, a logarithmic function.

113. In reſolving the equation

$$x^n+A'x^{n-1}+B'x^{n-2}\ldots+T=0,$$

it may happen that ſome of its roots a, a' a'', &c. are imaginary quantities, and then ſome of the ſimple factors $x+a$, $x+a'$, $x+a''$, &c. will be imaginary. Theſe factors always occur in pairs (ALGEBRA, § 179.) and have this form

$$x+\alpha+\beta\sqrt{-1},\qquad x+\alpha-\beta\sqrt{-1},$$

ſo that their product

$$x^2+2\alpha x+\alpha^2+\beta^2$$

is a real factor of the ſecond degree. As every correſponding pair of imaginary ſimple factors may be united in this manner into a real factor of the ſecond degree, if theſe factors are all unequal, we may avoid introducing imaginary quantities into the fluent of the propoſed fraction by proceeding thus. Let $x+\alpha+\beta\sqrt{-1}$ and $x+\alpha-\beta\sqrt{-1}$, denote two correſponding imaginary ſimple factors of the denominator. Inſtead of the two ſimple fractions

$$\frac{N\dot{x}}{x+\alpha+\beta\sqrt{-1}},\qquad\frac{N'\dot{x}}{x+\alpha-\beta\sqrt{-1}},$$

which would have been aſſumed if the factors had been real, aſſume a ſingle fraction

$$\frac{(Kx+L)\dot{x}}{x^2+2\alpha x+\alpha^2+\beta^2}$$

the denominator of which is a real function of x of the ſecond degree, viz. that which is the product of the two imaginary factors. Here K and L denote two conſtant but indeterminate coefficients, the values of which, as alſo thoſe of the other indeterminate coefficients are to be found as before.

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If the denominator of the propoſed fraction have ſeveral equal factors of the ſecond degree reſulting from its imaginary ſimple factors, ſo that the product of thoſe equal factors is

$$(x^2+2\alpha x+\alpha^2+\beta^2)^q;$$

then, correſponding to this product, we muſt, among the fractions having indeterminate coefficients, aſſume one of this form

$$\frac{(Q'x^{2q-1}+R'x^{2q-2}\ldots+Y')\dot{x}}{(x^2+2\alpha x+\alpha^2+\beta^2)^q},$$

where Q', R' ... Y' denote conſtant and indeterminate coefficients, the values of which will be found in all reſpects as thoſe of the others.

We are now to find the fluents of theſe two fluxional expreſſions, beginning with the firſt, viz.

$$\frac{(Kx+L)\dot{x}}{x^2+2\alpha x+\alpha^2+\beta^2},\qquad\text{or}\quad\frac{(Kx+L)\dot{x}}{(x+\alpha)^2+\beta^2}.$$

Put $x+\alpha=z$, then it becomes

$$\frac{(Kz+L-K\alpha)\dot{z}}{z^2+\beta^2};$$

and this again, by putting $L-K\alpha=M$, is reſolved into theſe two fluxions

$$\frac{Kz\dot{z}}{z^2+\beta^2}+\frac{M\dot{z}}{z^2+\beta^2}.$$

We can immediately find the fluent of the firſt of theſe, by putting $z^2+\beta^2=v$, for then $z\dot{z}=\frac{\dot{v}}{2}$, and

$$\int\frac{Kz\dot{z}}{z^2+\beta^2}=\frac{K}{2}\int\frac{\dot{v}}{v}=K\tfrac{1}{2}\,l.\,v,\ (\S\ 103.),$$
$$=K\,l.\sqrt{(z^2+\beta^2)}.$$

With reſpect to the other fluxion, if we put $z=\beta y$, we have

$$\frac{M\dot{z}}{z^2+\beta^2}=\frac{M}{\beta}\frac{\dot{y}}{1+y^2},$$

but we have ſeen (§ 60.) that $\frac{\dot{y}}{1+y^2}$ is the fluxion of an arch of which the tangent is y, therefore

$$\int\frac{M}{\beta}\frac{\dot{y}}{1+y^2}=\frac{M}{\beta}\text{ arc (tan.}=y)+\text{conſt.}$$
$$=\frac{M}{\beta}\text{ arc (tan.}=\tfrac{z}{\beta})+\text{conſt.}$$

It is proper to remark that if $\frac{z}{\beta}$ be the tangent of an arch, then the ſine of that arch is $\frac{z}{\sqrt{(z^2+\beta^2)}}$, and its coſine is $\frac{\beta}{\sqrt{(z^2+\beta^2)}}$, thus we may expreſs the fluent

under different forms, by introducing the ſine or coſine of the arch inſtead of its tangent.

If inſtead of x we ſubſtitute in theſe two fluents $x+\alpha$ we find that the fluent of $\frac{(Kx+L)\dot{x}}{x^2+2\alpha x+\alpha^2+\beta^2}$ is

$$Kl.\sqrt{(x^2+2\alpha x+\alpha^2+\beta^2)} + \frac{L-K\alpha}{\beta}\text{arc }(\tan.=\tfrac{x}{\beta}) + \text{conſt.}$$

114. To find the fluent of the expreſſion

$$\frac{(Q'x^{2q-1}+R'x^{2q-2}\ldots+Y')\dot{x}}{(x^2+2\alpha x+\alpha^2+\beta^2)^q},$$

we firſt transform it to

$$\frac{(Kx+L)\dot{x}}{(x^2+2\alpha x+\alpha^2+\beta^2)^q} + \frac{(K'x+L')\dot{x}}{(x^2+2\alpha x+\alpha^2+\beta^2)^{q-1}} \ldots + \frac{(K'''\ldots x+L'''\ldots)\dot{x}}{x^2+2\alpha x+\alpha^2+\beta^2},$$

where K, L, K′, L′, &c. denote indeterminate but conſtant coefficients, which may be determined by reducing theſe fractions to a common denominator, and proceeding as in the two preceding §§. Then the whole difficulty is reduced to the finding of the fluxion of the expreſſion

$$\frac{(Kx+L)\dot{x}}{(x^2+2\alpha x+\alpha^2+\beta^2)^q} = \frac{(Kx+L)\dot{x}}{\big((x+\alpha)^2+\beta^2\big)^q},$$

where q denotes ſome integer number. To ſimplify this expreſſion put $x+\alpha=z$, and $L-K\alpha=M$, then it becomes $\frac{(Kz+M)\dot{z}}{(z^2+\beta^2)^q}$, which we ſhall now ſhew may be reduced to $\int\frac{H\dot{z}}{(z^2+\beta^2)^{q-1}}$. To effect this reduction we decompoſe its fluent into two parts

$$\int\frac{Kz\dot{z}}{(z^2+\beta^2)^q} + \int\frac{M\dot{z}}{(z^2+\beta^2)^q}.$$

The fluent of the firſt part may be immediately found by putting $z^2+\beta^2=v$; for then $z\dot{z}=\frac{\dot{v}}{2}$ and

$$\int\frac{Kz\dot{z}}{(z^2+\beta^2)^q} = \int\frac{K\dot{v}}{2v^q} = \frac{Kv^{-q+1}}{2(1-q)},$$

Let us now ſuppoſe that the fluent of the ſecond part $\frac{M\dot{z}}{(z^2+\beta^2)^q}$ is equal to the ſum of the algebraic function $\frac{Gz}{(z^2+\beta^2)^{q-1}}$, and another function, which is the fluent of $\frac{H\dot{z}}{(z^2+\beta^2)^{q-1}}$, that is, let us aſſume

$$\int\frac{M\dot{z}}{(z^2+\beta^2)^q} = \frac{Gz}{(z^2+\beta^2)^{q-1}} + \int\frac{H\dot{z}}{(z^2+\beta^2)^{q-1}},$$

where G and H are conſtant but indeterminate coefficients. To determine theſe let the fluxion of each ſide of this equation be taken (obſerving that the fluxion of a quantity having the ſign $\int$ prefixed to it is the ſame quantity only without that ſign); thus we have

$$\frac{M\dot{z}}{(z^2+\beta^2)^q} = \frac{G\dot{z}}{(z^2+\beta^2)^{q-1}} - \frac{2(q-1)Gz\dot{z}}{(z^2+\beta^2)^q} + \frac{H\dot{z}}{(z^2+\beta^2)^{q-1}},$$

and from this equation, by rejecting what is common to each term, we find

$$M=G(z^2+\beta^2)-2(q-1)Gz^2+H(z^2+\beta^2),$$

and hence

$$M=G\beta^2+H\beta^2+(G-2(q-1)G+H)z^2;$$

Therefore by comparing together like terms we find

$$M=G\beta^2+H\beta^2, \qquad G-2(q-1)G+H=0;$$

and from theſe equations we get

$$G=\frac{M}{(2q-2)\beta^2}, \qquad H=\frac{(2q-3)M}{(2q-2)\beta^2}.$$

Let theſe values of G and H be now ſubſtituted in our aſſumed equation, and it becomes

$$\int\frac{M\dot{z}}{(z^2+\beta^2)^q} = \frac{M}{(2q-2)\beta^2}\frac{z}{(z^2+\beta^2)^{q-1}} + \frac{M(2q-3)}{(2q-2)\beta^2}\int\frac{\dot{z}}{(z^2+\beta^2)^{q-1}}.$$

Thus we have reduced the determination of the fluent of $\frac{M\dot{z}}{(z^2+\beta^2)^q}$ to that of $\frac{\dot{x}}{(z^2+\beta^2)^{q-1}}$, and by proceeding in the ſame manner with this laſt fluxion, its fluent may be made to depend on that of $\frac{\dot{z}}{(z^2+\beta^2)^{q-2}}$; but this will be more readily effected by ſimply ſubſtituting $q-1$ inſtead of q, and ſuppoſing $M=1$ in the preceding equation.

Thus

Inverse Method.

Thus we shall obtain

$$\int \frac{\dot{z}}{(z^2+\beta^2)^{q-1}} = \frac{1}{(2q-4)\beta^2}\,\frac{z}{(z^2+\beta^2)^{q-2}} + \frac{(2q-5)}{(2q-4)\beta^2}\int \frac{\dot{z}}{(z^2+\beta^2)^{q-2}}$$

Substituting now this value of $\int \frac{\dot{z}}{(z^2+\beta^2)^{q-1}}$ in the former equation, we have $\int \frac{M\dot{z}}{(z^2+\beta^2)^q}$ equal to

$$\frac{M}{(2q-2)\beta^2}\,\frac{z}{(z^2+\beta^2)^{q-1}} = \frac{(2q-3)M}{(2q-2)(2q-4)\beta^4}\,\frac{z}{(z^2+\beta^2)^{q-2}} + \frac{(2q-3)(2q-5)M}{(2q-2)(2q-4)\beta^4}\int \frac{\dot{z}}{(z^2+\beta^2)^{q-2}}$$

It is easy to see, that like as we obtained an expression for the fluent of $\frac{\dot{z}}{(z^2+\beta^2)^{q-1}}$ by substituting $q-1$ for q, and supposing $M=1$, in the equation preceding the last; so by substituting $q-2$ for q, we shall obtain an expression for the fluent of $\frac{\dot{z}}{(z^2+\beta^2)^{q-2}}$, which expression will consist of two terms, one an algebraic function of z, and the other $\int \frac{\dot{z}}{(z^2+\beta^2)^{q-3}}$ multiplied by a constant and given coefficient. This value of $\frac{z}{(z^2+\beta^2)^{q-2}}$ when substituted in the last equation will produce an expression for $\int \frac{M\dot{z}}{(z^2+\beta^2)^q}$ consisting of algebraic quantities and $\int \frac{\dot{z}}{(z^2+\beta^2)^{q-3}}$. By continuing this process it is evident that we shall at last have $\int \frac{M\dot{z}}{(z^2+\beta^2)^q}$ expressed by a series of algebraic quantities, and $\int \frac{\dot{z}}{z^2+\beta^2}$, and here we must stop, for if we repeat the process with a view to make the fluent depend on $\int \frac{\dot{z}}{(z^2+\beta^2)^0}$ that is on $\int \dot{z}$, or z, we shall find that the coefficient of this quantity becomes infinite. As to the fluent of $\frac{\dot{z}}{z^2+\beta^2}$ we have exhibited the expression for it in last §.

In comparing together the results which have been obtained in the preceding articles, it must appear that when a fluxion is expressed by a rational fraction, if we grant the resolution of equations, the fluent may always be assigned either algebraically, or by means of arches of a circle or logarithms; and that to prepare it for a solution, we must decompose the fraction into others, whose denominators may be either binomial or trinomial quantities. This decomposition may always be effected by the method of indeterminate coefficients. There are, however, several analytical artifices by which the labour of calculation may be greatly shortened. These we now proceed to explain.

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115. Let us recur to the fraction $\frac{U}{V}$ and suppose that $x+a$ is one of the unequal factors of the denominator V, so that we have $V=(x+a)Q$; Let us now put $\frac{U}{V}=\frac{A}{x+a}+\frac{P}{Q}$, A being supposed a constant quantity, and P an indeterminate function of x, but such as not to be divisible by $x+a$. Then we have $U=AQ+P(x+a)$, and hence $P=\frac{U-AQ}{x+a}$. As P is an integer function with respect to x, it follows from this equation that $U-AQ$, which is also a rational and integer function of x, is divisible by $x+a$, and consequently has $x+a$ for a factor; therefore, the function $U-AQ$ will vanish when we substitute $-a$ in it instead of x, seeing that $-a$ is the value of x that makes the factor $x+a=0$. Let us denote by u and q, what U and Q become by this substitution, which however will not affect the indeterminate quantity A, because it is independent of x. We have therefore $u-Aq=0$, and consequently $A=\frac{u}{q}$.

This value of A requires that we should know the function Q given by the equation $V=(x+a)Q$, and we may always find it by dividing V by $a+x$. The direct method of fluxions affords also a very simple method of determining it. For by taking the fluxion of the above equation we have

$$\frac{\dot{V}}{\dot{x}} = Q + (x+a)\frac{\dot{Q}}{\dot{x}};$$

if in this result we make $x+a=0$, or $x=-a$, and denote by v what $\frac{\dot{V}}{\dot{x}}$ becomes by that substitution, we shall have $v=q$, and consequently $A=\frac{u}{v}$.

The expression $A=\frac{u}{q}$ has always a finite value, for the numerator and denominator can never become $=0$, because we suppose the fraction $\frac{U}{V}$ reduced to its lowest terms, and consequently, that the numerator U has not for a factor $x+a$, which is a factor of the denominator, but which being contained in it only once does not enter into Q.

116. Let us now consider how the numerators of the fractions, into which the proposed fraction $\frac{U}{V}$ is to be decomposed, are to be found in the case of the denomi-

Inverse Method.

nator V having equal factors of the first degree. In this case we have $V=Q(x+a)^n$, and we assume

$$\frac{U}{V}=\frac{A}{(x+a)^n}+\frac{B}{(x+a)^{n-1}}+\frac{C}{(x+a)^{n-2}}\cdots+\frac{N}{x+a}+\frac{P}{Q}.$$

By reducing to a common denominator, we find U equal to

$$Q\left\{\begin{matrix}A+B(x+a)+C(x+a)^2\\ \cdots+N(x+a)^{n-1}\end{matrix}\right\}+P(x+a)^n$$

and P equal to

$$\frac{U-Q\left(A+B(x+a)+C(x+a)^2\cdots+N(x+a)^{n-1}\right)}{(x+a)^n}$$

and as P ought to be an integer function of x, the numerator of its value is necessarily divisible n times successively by $x+a$; therefore, that numerator ought to be equal to 0, when $-a$ is substituted in it instead of x. Now this substitution being made, each of the terms of the numerator which is multiplied by $x+a$ vanishes, so that there remains only $U-AQ$, but that this quantity may be divisible by $x+a$ it is necessary that $u-qA=0$, where u and q denote the same as in last §, hence $A=\frac{u}{q}$.

This value of A changes $U-QA$ into $U-\frac{u}{q}Q$, which must be divisible by $x+a$. Let us, with a view to abridge, put $U-\frac{u}{q}Q=U'(x+a)$, then, substituting this quantity in the value of P, and dividing both numerator and denominator by $x+a$, we have P equal to

$$\frac{U'-Q\left(B+C(x+a)\cdots+N(x+a)^{n-2}\right)}{(x+a)^{n-1}}.$$

Now to obtain B we make $x+a=0$, then, putting u' to denote what U' becomes by substituting $-a$ in it in place of x, we have $u'-qB=0$, and $B=\frac{u'}{q}$.

Instead of B let its value be substituted in $U'-QB$, and this quantity becomes $U'-\frac{u'}{q}Q$, which vanishing when $x+a=0$, will have $x+a$ for a divisor; therefore, we may put $U'-\frac{u'}{q}Q=U''(x+a)$, then, substituting this last quantity instead of the former in the value of P, and dividing the numerator and denominator by $x+a$, we have P equal to

$$\frac{U''-Q(C+D(x+a)\cdots+N(x+a)^{n-3})}{(x+a)^{n-2}}.$$

By continuing the same mode of reasoning, and the same notation, we find $u''-qC=0$, and $C=\frac{u''}{q}$. And so on with the remaining quantities.

The direct method of fluxions facilitates greatly the preceding operations. For the numerator of P being divisible by $(x+a)^n$ is necessarily of this form $X(a+x)^n$, X being an integer function of x, but which does not contain the factor $x+a$. Now agreeably to what has been shewn in § 88, the successive fluxions of this numerator, as far as the $n-1$ order inclusive, vanish when $x+a$ is supposed $=0$. By giving to the numerator the following form

$$Q\left(\frac{U}{Q}-A-B(x+a)-C(x+a)^2\cdots\right)$$

and observing that the function Q does not contain the factor $x+a$, it is manifest that it is only the part of this expression between the parentheses which ought to be divisible by $(x+a)^n$. Let us put $\frac{U}{Q}=Z$, then the successive fluxions of that part are

$$\dot{Z}-B\dot{x}-2C(x+a)\dot{x}-3D(x+a)^2\dot{x}\cdots$$

$$\ddot{Z}-2C\dot{x}^2-2\cdot3D(x+a)\dot{x}^2\cdots$$

$$\dddot{Z}-2\cdot3D\dot{x}^3\cdots$$

&c.

and these results ought all to vanish when we put $x+a=0$. Thus we have

$$Z-A=0, \text{ and } A=\frac{u}{q},$$

$$\dot{Z}-B\dot{x}=0,\quad B=\frac{\dot{Z}}{\dot{x}},$$

$$\ddot{Z}-2C\dot{x}^2=0,\quad C=\frac{\ddot{Z}}{2\dot{x}^2},$$

$$\dddot{Z}-2.3D\dot{x}^3=0,\quad D=\frac{\dddot{Z}}{2\cdot3\dot{x}^3},$$

&c. &c.

observing that in each of these functions $\frac{\dot{Z}}{\dot{x}}$, $\frac{\ddot{Z}}{2\dot{x}^2}$, we must substitute $-a$ instead of x.

The most simple way to find the value of Q in this case is to divide V by $(x+a)^n$, but we may also find it by the direct method of fluxions, as in the preceding §; for, since $V=Q(x+a)^n$, if we take the fluxion of each side of this equation n times, and then make $x+a=0$, we shall find, § 88, the nth fluxion of V equal to $1\cdot2\cdot3\cdots nQ\dot{x}^n$, and consequently

$$Q=\frac{n\text{th flux. of V}}{1\cdot2\cdots n\dot{x}^n}.$$

117. Let us now consider how we are to find the numerator of the fraction which forms a part of $\frac{U}{V}$ when it has this form

$$\frac{Ax+B}{x^2+2\alpha x+\alpha^2+\beta^2}.$$

Assume

Inverſe Method.

Aſſume

$$\frac{U}{V}=\frac{Ax+B}{x^2+2\alpha x+\alpha^2+\beta^2}+\frac{P}{Q};$$

then, reducing the latter part of this equation to a common denominator, we find

$$U=Q(Ax+B)+P(x^2+2\alpha x+\alpha^2+\beta^2).$$

Hence we deduce

$$P=\frac{U-Q(Ax+B)}{x^2+2\alpha x+\alpha^2+\beta^2}.$$

As P is ſuppoſed to be an integer function with reſpect to x, it follows that $U-Q(Ax+B)$ is diviſible by $x^2+2\alpha x+\alpha^2+\beta^2$; therefore, the former of theſe two quantities muſt contain among its factors thoſe of the latter, and the quantities, which, being ſubſtituted for x, cauſe the latter to vaniſh, muſt alſo make the former vaniſh. But the factors of $x^2+2\alpha x+\alpha^2+\beta^2$ are $x+\alpha+\beta\sqrt{-1}$, and $x+\alpha-\beta\sqrt{-1}$, and theſe, being put each $=0$, give us $x=-(\alpha+\beta\sqrt{-1})$, and $x=-(\alpha-\beta\sqrt{-1})$, therefore, each of theſe values of x being ſubſtituted in $U-Q(Ax+B)$ ought to make that quantity vaniſh. Let us denote by $u\pm u'\sqrt{-1}$, and by $q\pm q'\sqrt{-1}$ what U and Q reſpectively become when $-(\alpha\pm\beta\sqrt{-1})$ is ſubſtituted in each inſtead of x, then, after this transformation, we have

$$\left.\begin{matrix}u\pm u'\sqrt{-1}\\ -(q\pm q'\sqrt{-1})\end{matrix}\right\}\left\{-A(\alpha\pm\beta\sqrt{-1})+B\right\}=0.$$

This equation is twofold, becauſe of the ſign $\pm$ with which ſeveral of its terms are affected, and it is equivalent to thoſe which would be formed by putting the real part equal to 0, and the imaginary part $=0$; from this conſideration we have

$$u+q\alpha A-q'\beta A-qB=0,$$

$$u'+q\beta A+q'\alpha A-q'B=0,$$

two equations which give us the values of A and B.

The function Q may be found as in § 115. For, if we take the fluxions of each ſide of the equation

$$Q(x^2+2\alpha x+\alpha^2+\beta^2)=V,$$

and afterwards make

$$x^2+2\alpha x+\alpha^2+\beta^2=0,$$

we find $Q(2x\dot{x}+2\alpha\dot{x})=\dot{V}$ and hence

$$Q=\frac{\dot{V}}{2x\dot{x}+2\alpha\dot{x}};$$

Let the two values of x, to wit $-(\alpha\pm\beta\sqrt{-1})$, be ſubſtituted inſtead of it in this equation, then, putting $v\pm v'\sqrt{-1}$ to denote what the expreſſion $\frac{\dot{V}}{\dot{x}}$ becomes by that ſubſtitution, and writing $q\pm q'\sqrt{-1}$ inſtead of Q, we have

$$q\pm q'\sqrt{-1}=\frac{v\pm v'\sqrt{-1}}{\mp 2\beta\sqrt{-1}},$$

which, by multiplying the terms of the fraction on the latter ſide of the equation by $\sqrt{-1}$, becomes

$$q\pm q'\sqrt{-1}=\frac{v'\sqrt{-1}\mp v'}{\mp 2\beta}.$$

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Hence, by putting the real part of each ſide of this equation equal to each other, and alſo the imaginary parts equal to each other, we find

$$q=-\frac{v'}{2\beta},\quad q'=\frac{v}{2\beta}.$$

118. If the factor $x^2+2\alpha x+\alpha^2+\beta^2$ is found ſeveral times in the denominator of V, ſo that $V=Q(x^2+2\alpha x+\alpha^2+\beta^2)^n$, then, § 113, we aſſume in this caſe $\frac{U}{V}$ equal to

$$\frac{Ax+B}{(x^2+2\alpha x+\alpha^2+\beta^2)^n}+\frac{A'x+B'}{(x^2+2\alpha x+\alpha^2+\beta^2)^{n-1}}+\frac{A''x+B}{(x^2+2\alpha x+\alpha^2+\beta^2)^{n-2}}\cdots+\frac{P}{Q}$$

reducing this expreſſion to a common denominator, and ſo ordering the equation as to bring P to ſtand alone on one ſide, we find P equal to

$$\frac{U-Q\left\{\begin{matrix}Ax+B+(A'x+B')(x^2+2\alpha x+\alpha^2+\beta^2)\\ +(A''x+B'')(x^2+2\alpha x+\alpha^2+\beta^2)^2\cdots\end{matrix}\right\}}{(x^2+2\alpha x+\alpha^2+\beta^2)^n}$$

By reaſoning in this as in the preceding caſe, it may be concluded that the numerator of this expreſſion ought to vaniſh when $-(\alpha\pm\beta\sqrt{-1}$ is ſubſtituted in it inſtead of x; therefore, putting $u\pm u'\sqrt{-1}$, and $q\pm q'\sqrt{-1}$ to denote the ſame things as before, we deduce from that ſubſtitution

$$\left.\begin{matrix}u\pm u'\sqrt{-1}\\ -(q\pm q'\sqrt{-1})\end{matrix}\right\}\left(-A(\alpha\pm\beta\sqrt{-1})+B\right)=0$$

the very ſame equation for the determination of A and B, as we have already found in laſt §.

Having found the values of theſe quantities, they may be ſubſtituted in the numerator of P, and the term $U-Q(Ax+B)$ becoming diviſible by $x^2+2\alpha x+\alpha^2+\beta^2$, the whole expreſſion becomes diviſible by the ſame quantity. Calling therefore U′ the quotient ariſing from the diviſion of $U-Q(Ax+B)$ by $x^2+2\alpha x+\alpha^2+\beta^2$, we have P equal to

$$\frac{U'-Q[A'x+B'+(A''x+B'')(x^2+2\alpha x+\alpha^2+\beta^2)\ldots]}{(x^2+2\alpha x+\alpha^2+\beta^2)^{n-1}}$$

. If in this numerator we ſubſtitute inſtead of x its values deduced from the equation $x^2+2\alpha x+\alpha^2+\beta^2=0$, and put the reſult $=0$, we may determine A′ and B′ in the very ſame way that we have already determined A and B, and by proceeding in this manner we ſhall find the remaining coefficients A″, B″, &c.

This caſe is quite analogous to that which has been already treated in § 116, and the direct method of fluxions applies to it in the ſame manner as to the other. For ſince Q does not contain the factor $x^2+2\alpha x+\alpha^2+\beta^2$, if the numerator of P be divided by the function Q, the reſult, which may be denoted by r, ought to be of this form

Inverſe Method.

form $r=X(x^2+2\alpha x+\alpha^2+\beta^2)^n$ and conſequently ought to vaniſh, as well as all its fluxions, from the firſt order to the $n-1$ order, incluſively, when $x^2+2\alpha x+\alpha^2+\beta^2=0$; this being the caſe, we have theſe equations

$$r=0, \dot{r}=0, \ddot{r}=0, \ldots$$

and ſo on to the $n-1$ fluxion of r, which ought alſo to be $=0$; each of theſe equations becomes twofold when we ſubſtitute inſtead of x, the values of which it is ſuſceptible in conſequence of the equation $x^2+2\alpha x+\alpha^2+\beta^2=0$. By putting the real and the imaginary parts ſeparately $=0$, we ſhall obtain as many equations as are ſufficient to determine A, B, A′, B′, &c.

It may alſo be remarked, that from the equation

$$V=Q(x^2+2\alpha x+\alpha^2+\beta^2)^i$$

we find Q equal to the quotient ariſing from the diviſion of the nth fluxion of V by the nth fluxion of $x^2+2\alpha x+\alpha^2+\beta^2$, obſerving to aſſume

$$x^2+2\alpha x+\alpha^2+\beta^2=0.$$

119. We ſhall now give ſome applications of what has been ſaid relative to the fluents of rational fractions. Suppoſe the fraction to be

$$\frac{\dot{x}}{x^8+x^7-x^6-x^5};$$

The factors of its denominator are eaſily found, for it may be put under this form

$$x^5(x^5+x^4-x-1)=x^5(x+1)(x^4-1),$$

the factor x^4-1 may be decompoſed into x^2-1 and x^2+1, or $x-1$, $x+1$, and x^2+1, thus we have the denominator equal to

$$x^5(x-1)(x+1)^2(x^2+1)$$

therefore (§ 111, § 112, and § 113.) the propoſed fraction is to be decompoſed as follows

$$\frac{A\dot{x}}{x-1}+\frac{B\dot{x}}{(x+1)^2}+\frac{C\dot{x}}{x+1}$$
$$+\frac{D\dot{x}}{x^1}+\frac{E\dot{x}}{x^2}+\frac{F\dot{x}}{x}+\frac{(Gx+H)\dot{x}}{1+x^2}$$

By reducing theſe fractions to a common denominator, and comparing the numerator of their ſum with that of the propoſed fraction, we might determine the unknown quantities A, B, C, &c. we ſhall, however, rather employ the methods that have juſt been explained.

By comparing this particular example $\frac{\dot{x}}{x^8+x^7-x^6-x^5}$ with the general expreſſion $\frac{U\dot{x}}{V}$, it appears that $U=1$, and $V=x^8+x^7-x^6-x^5$. Firſt let us inveſtigate the numerator of the fraction $\frac{A}{x-1}$, and for this purpoſe we employ the formula $A=\frac{u}{v}$ (§ 115.). As we have $U=1$, it is evident that $u=1$; and ſince $V=x^8+x^7-x^6-x^5$, therefore $\frac{\dot{V}}{\dot{x}}=8x^7+7x^6-4x^3-3x^2$. If in this expreſſion we ſubſtitute $+1$ inſtead of x (viz. the value of x deduced from the equation $x-1=0$) we find the reſult to be 8, therefore $v=8$. So that

$$A=\frac{u}{v}=\frac{1}{8}, \text{ and } \frac{A}{x-1}=\frac{1}{8}\frac{1}{x-1}.$$

Let us next inveſtigate the values of B and C in the fractions $\frac{B}{(x+1)^2}$, and $\frac{C}{x+1}$, by means of the rule of § 116, and that we may make the ſymbols expreſſing the quantity under conſideration agree with thoſe employed in that formula, let us exchange the letters B and C for A and B, ſo that we are to conſider $\frac{A}{(x+1)^2}+\frac{B}{x+1}$. In the firſt place we have

$$Q=\frac{x^8+x^7-x^4-x^3}{(x+1)^2}=x^6-x^5+x^4-x^3;$$

Put $x+1=0$, then $x=1$; ſubſtituting now this value of x in the value of Q, the reſult is $4=q$, therefore $A=\frac{u}{q}=\frac{1}{4}$. Let this value of A be ſubſtituted for A in the expreſſion for U′ in the § above cited, and we have

$$U'=\frac{U-AQ}{x+1}=\frac{4-x^6+x^5-x^4+x^3}{4(x+1)}$$
$$=\frac{7-x^5+2x^4-3x^3+4x^2-4x+4}{4}$$

Hence putting -1 inſtead of x in the expreſſion for U′, we have $u'=\frac{9}{2}$ and $B=\frac{u'}{q}=\frac{9}{8}$. Thus the two fractions under conſideration are found to be $\frac{1}{4}\cdot\frac{1}{(x+1)^2}$ and $\frac{9}{8}\cdot\frac{1}{x+1}$. We might have deduced the value of B from the formula $B=\frac{\dot{Z}}{\dot{x}}$, § 116, where Z is put for $\frac{U}{Q}$ for we have

$$Z=\frac{U}{Q}=\frac{1}{x^6-x^5+x^4-x^3},$$
$$\text{and } \frac{\dot{Z}}{\dot{x}}=-\frac{6x^5-5x^4+4x^3-3x^2}{(x^6-x^5+x^4-x^3)^2}.$$

If in this expreſſion we ſubſtitute -1 inſtead of x, it becomes $\frac{18}{16}=\frac{9}{8}$, the ſame value for B as before.

Let us now conſider the fractions $\frac{D}{x^3}+\frac{E}{x^2}+\frac{F}{x}$, or exchanging the ſymbols D, E, F for A, B, C,

$$\frac{A}{x^3}+\frac{B}{x^2}+\frac{C}{x}.$$

The numerators A, B, C may all be found from theſe formulas of § 116.

A=

$$A=\frac{U}{Q}=Z,\ B=\frac{\dot{Z}}{\dot{x}},\ C=\frac{\ddot{Z}}{1.2\dot{x}^2},$$

obſerving that in this caſe $Q=x^5+x^4-x-1$; and that we muſt ſubſtitute 0 inſtead of x in each formula, after taking the fluxions. Now we have

$$Z=\frac{U}{Q}=\frac{1}{x^5+x^4-x-1},$$

$$\frac{\dot{Z}}{\dot{x}}=-\frac{5x^4+4x^1-1}{(x^5+x^4-x-1)^2},$$

$$\frac{\ddot{Z}}{\dot{x}^2}=-\frac{20x^3+12x^2}{(x^5+x^4-x-1)^2}$$

$$\frac{+2(5x^4+4x^1-1)^2}{(x^5+x^4-x-1)^3};$$

Hence putting $x=0$, we find

$$A=-1,\ B=+1,\ C=-1,$$

ſo that

$$\frac{A}{x^3}+\frac{B}{x^2}+\frac{C}{x}=-\frac{1}{x^3}+\frac{1}{x^2}-\frac{1}{x}$$

There yet remains the fraction $\frac{Gx+H}{x^2+1}$, or $\frac{Ax+B}{x^2+1}$ to be conſidered. It may be found by ſubtracting the ſum of all the others from the propoſed fraction; we proceed however to find it directly by the formulas of § 117. In the firſt place we have $Q=x^6+x^5-x^4-x^3$; next, the factor x^2+1 being put $=0$ gives $x=\pm\sqrt{-1}$ $\alpha=0$, $\beta=0$. Hence we find

$$q=\pm q'\sqrt{-1}=-2=\pm 2\sqrt{-1},\ u=1,\text{ and } u'=0.$$

The equations which determine A and B thus become

$$1+2A+2B=0,\quad 2A-2B=0,$$

therefore $A=B=-\frac{1}{4}$, and

$$\frac{Ax+B}{x^2+1}=\frac{1}{4}\cdot\frac{x+1}{x^2+1}$$

Thus upon the whole, the propoſed fraction

$\frac{\dot{x}}{x^8+x^7-x^4-x^3}$ is decompoſed into the following

$$\frac{1}{8}\cdot\frac{\dot{x}}{x-1}+\frac{1}{4}\cdot\frac{\dot{x}}{(x+1)^2}+\frac{9}{8}\frac{\dot{x}}{x+1}$$

$$-\frac{\dot{x}}{x^1}+\frac{\dot{x}}{x^2}-\frac{\dot{x}}{x}-\frac{1}{4}\cdot\frac{(x+1)x}{x^2+1}-$$

The manner of finding the fluent of each of theſe has been already explained, and the reſult of taking all the fluents is

$$\left.\begin{array}{l}\frac{1}{8}\text{ l. }(x-1)-\frac{1}{4}\cdot\frac{1}{x+1}\\ +\frac{9}{8}\text{ l. }(x+1)+\frac{1}{2x^2}-\frac{1}{x}-\text{l. }x\\ -\frac{1}{8}(x^2+1)-\frac{1}{4}\text{ arc (tan.}=x)+\text{conſt.}\end{array}\right\}$$

The union of all the algebraic terms produces the fraction $\frac{2-2x-5x^2}{4x^2(1+x)}$, and that of the logarithmic quantities gives

$$\frac{1}{8}\text{l. }(x-1)+\frac{1}{8}\text{l. }(x+1)+\text{l. }(x+1)$$

$$-\frac{1}{8}\text{l. }(x^2+1)-\text{l. }x$$

$$=\frac{1}{8}\text{ l. }\left(\frac{x^2-1}{x^2+1}\right)+\text{l. }\left(\frac{x+1}{x}\right).$$

We have therefore upon the whole $\int\frac{\dot{x}}{x^8+x^7-x^4-x^3}$ equal to

$$\frac{2-2x-5x^2}{4x^2(1+x)}+\frac{1}{8}\text{ l. }\left(\frac{x^2-1}{x^2+1}\right)$$

$$+\text{l. }\left(\frac{x+1}{x}\right)-\frac{1}{4}\text{arc (tan.}=x)+\text{conſt.}$$

120. When a fluxion is a rational fraction having either of theſe forms

$$\frac{x^m\dot{x}}{x^n\pm a^n},\quad \frac{x^m\dot{x}}{x^{2n}\pm 2pa^nx^n+a^n},$$

we can always, by the application of a particular theorem in analyſis, reſolve its denominator into real factors of the firſt and ſecond degrees. The theorem to which we allude is this. Let n be any poſitive integer, and let z denote any arch of a circle, of which the radius is unity, then

$(\text{cof. } z\pm\sqrt{-1}\text{ ſin. } z)^n=\text{cof. } nz\pm\sqrt{-1}\text{ ſin. } nz.$

We proceed to prove this theorem. Becauſe

$$(\text{cof. } z+\sqrt{-1}\text{ ſin. } z)(\text{cof. } z-\sqrt{-1}\text{ ſin. } z$$

$$=\text{cof.}^2 z+\text{ſin.}^2 z=1.$$

If we put $\text{cof. } z\pm\sqrt{-1}\text{ ſin. } z=v$,

Then $\text{cof. } z\mp\sqrt{-1}\text{ ſin. } z=\frac{1}{v}$;

Therefore taking the ſum of theſe two equations,

$$2\text{ cof. } z=v+\frac{1}{v}.$$

Now by the arithmetic of ſines (Algebra, § 358.)

$2\text{ cof. } 2z=2(2\text{ cof. } z\times\text{cof. } z-1)$,

$2\text{ cof. } 3z=2(2\text{ cof. } z\times\text{cof. } 2z-\text{cof. } z)$,

$2\text{ cof. } 4z=2(2\text{ cof. } z\times\text{cof. } 3z-\text{cof. } 2z)$,

$2\text{ cof. } 5z=2(2\text{ cof. } z\times\text{cof. } 4z-\text{cof. } 3z)$.

&c.

Therefore, ſubſtituting in the firſt of theſe equations $v+\frac{1}{v}$ inſtead of $2\text{ cof. } z$, we have

2 cof.

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$$2 \text{ cof. } 2z=\left(v+\frac{1}{v}\right)\left(v+\frac{1}{v}\right)-2$$

$$=v^2+\frac{1}{v^2}.$$

In like manner, ſubſtituting in the ſecond equation, $v+\frac{1}{v}$ inſtead of 2 cof. z, and $v^2+\frac{1}{v^2}$ inſtead of 2 cof. 2 z, we have

$$2 \text{ cof. } 3z=\left(v+\frac{1}{v}\right)\left(v^2+\frac{1}{v^2}\right)-\left(v+\frac{1}{v}\right)$$

$$=v^3+\frac{1}{v^3}.$$

Proceeding in the ſame way with the third and following equations, we find

$$2 \text{ cof. } 4z=v^4+\frac{1}{v^4},$$

$$2 \text{ cof. } 5z=v^5+\frac{1}{v^5};$$

ſo that we may conclude in general that

$$2 \text{ cof. } nz=v^n+\frac{1}{v^n};$$

Hence we have this quadratic equation

$$v^{2n}-2 \text{ cof. } nz \times v^n+1=0,$$

from which, by completing the ſquare, we find

$$v^n=\text{cof. } nz \pm \sqrt{(\text{cof.}^2 nz-1)};$$

therefore, by ſubſtituting for v the quantity it was put to repreſent, and obſerving that $\sqrt{(\text{cof.}^2 nz-1)}=\sqrt{(-\text{ſin.}^2 nz)}=\sqrt{-1}$ ſin. nz, we have

$(\text{cof. } z \pm \sqrt{-1} \text{ ſin. } z)^n=\text{cof. } nz \pm \sqrt{-1} \text{ ſin. } nz$,

as was to be proved.

121. The function $x^n \pm a_n$ is transformed to $a^n(y^n \pm 1)$ by putting $x=ay$, and to diſcover its factors, we muſt reſolve the equation

$$y^n \pm 1=0.$$

The expreſſion $y=\text{cof. } z+\sqrt{-1}$ ſin. z ſatisfies this equation, by a very ſimple determination of the arch z; for we have $y^n=(\text{cof. } z+\sqrt{-1} \text{ ſin. } z)^n=\text{cof. } nz+\sqrt{-1}$ ſin. nz, and as by putting π to denote half the circumference, and m any whole number, we have (ALGEBRA, § 352)

$$\text{ſin. } m\pi=0, \text{ cof. } m\pi=\pm 1,$$

where the ſign + is to be taken, if m be an even number, but − if it be odd, we have only to ſuppoſe $nz=m\pi$, in order to obtain $y^n=\pm 1$.

That we may diſtinguiſh the caſe in which m is even, from that in which it is odd, we ſhall write for the firſt $2m$, and for the ſecond $2m+1$; we therefore make

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$$nz=2m\pi, \text{ and } nz=(2m+1)\pi.$$

By the firſt hypotheſis, we find

$$y^n=+1, y=\text{cof. } \frac{2m\pi}{n}+\sqrt{-1} \text{ ſin. } \frac{2m\pi}{n},$$

and by the ſecond

$$y^n=-1,$$

$$y=\text{cof. } \frac{(2m+1)\pi}{n}+\sqrt{-1} \text{ ſin. } \frac{(2m+1)\pi}{n}.$$

122. By means of the indeterminate number n, each of theſe expreſſions for y furniſhes all the values of which this quantity is ſuſceptible, for we may take ſucceſſively

$$m=0, m=1, m=2, m=3, \&c.$$

The firſt formula gives

$$y=\text{cof. } 0.\pi=1$$

$$y=\text{cof. } \frac{2\pi}{n}+\sqrt{-1} \text{ ſin. } \frac{2\pi}{n},$$

$$y=\text{cof. } \frac{4\pi}{n}+\sqrt{-1} \text{ ſin. } \frac{4\pi}{n},$$

&c.

It is evident that we ſhall always have different reſults as far as $m=n-1$. If, however we ſuppoſe $m=n$, then we have $y=\text{cof. } 2=1\pi$, which is the ſame as the firſt of the values already obtained, and if we ſuppoſe $m=n+1$, then (ALGEBRA, § 25.)

$$\text{Cof. } \frac{(2n+2)}{n}\pi=\text{cof. } \left(2\pi+\frac{2\pi}{n}\right)=\text{cof. } \frac{2\pi}{n},$$

$$\text{Sin. } \frac{(2n+2)\pi}{n}=\text{ſin. } \left(2\pi+\frac{2\pi}{n}\right)=\text{ſin. } \frac{2\pi}{n},$$

which is the ſame as the ſecond value, and ſo on with reſpect to the others.

By this mode of proceeding we ſhall not only obtain the n roots of the equation $y^n=1$, or $y^n-1=0$, but, with a little attention, we ſhall diſcover that theſe roots may be arranged in pairs, by bringing together thoſe that only differ in the ſign of the radical $\sqrt{-1}$; for ſince

$$\text{Cof. } (2\pi-p)=\text{cof. } p, \text{ and ſin. } (2\pi-p)=-\text{ſin. } p,$$

it follows that

$$y=\text{cof. } \frac{(2n-2m)\pi}{n}+\sqrt{-1} \text{ ſin. } \frac{(2n-2m)\pi}{n}$$

$$=\text{cof. } \frac{2m\pi}{n}-\sqrt{-1} \text{ ſin. } \frac{2m\pi}{n}.$$

Hence it appears that we may comprehend all the roots of the equation $y^n-1=0$ in the ſingle expreſſions

$y=$

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$$y=\text{cof.}\frac{2m\pi}{n}\pm\sqrt{-1}\,\text{ſin.}\frac{2m\pi}{n},$$

by giving to m only theſe values

$$0,\ 1,\ 2,\ \ldots\ \frac{n}{2},$$

if n is even, and theſe values

$$0,\ 1,\ 2,\ \ldots\ \frac{n-1}{2},$$

if n is odd; and it may be obſerved that in the former caſe the laſt value of y is

$$y=\text{cof.}\ \pi=-1,$$

becauſe that then the equation $y^n-1=0$ has two real roots.

The two values comprehended in the formula,

$$y=\text{cof.}\frac{2m\pi}{n}+\sqrt{-1}\,\text{ſin.}\frac{2m\pi}{n}$$

give for factors of the firſt degree of the quantity y^n-1, the two imaginary expreſſions

$$y-\left(\text{cof.}\frac{2m\pi}{n}+\sqrt{-1}\,\text{ſin.}\frac{2m\pi}{n}\right),$$

$$y-\left(\text{cof.}\frac{2m\pi}{n}-\sqrt{-1}\,\text{ſin.}\frac{2m\pi}{n}\right),$$

and the product of theſe is the expreſſion

$$y^2-2y\,\text{cof.}\frac{2m\pi}{n}+1,$$

which comprehends all the real factors of the ſecond degree.

As an example of the formula

$$y=\text{cof.}\frac{2m\pi}{n}\pm\sqrt{-1}\,\text{ſin.}\frac{2m\pi}{n},$$

the ſimple factors, or thoſe of the firſt degree, contained in the function y^6-1 will be

$$y-1,$$

$$y-\left(\text{cof.}\frac{2\pi}{6}\pm\sqrt{-1}\,\text{ſin.}\frac{2\pi}{6}\right),$$

$$y-\left(\text{cof.}\frac{4\pi}{6}\pm\sqrt{-1}\,\text{ſin.}\frac{4\pi}{6}\right),$$

$$y+1.$$

The formula

$$y^2-2y\,\text{cof.}\frac{2m\pi}{n}+1$$

gives as factors of the ſecond degree

$$y^2-2y+1,$$

$$y^2-2y\,\text{cof.}\frac{2\pi}{6}+1,$$

$$y^2-2y\,\text{cof.}\frac{4\pi}{6}+1,$$

$$y^2+2y+1.$$

The firſt and the laſt of the factors of the ſecond degree are the ſquares of $y-1$, and $y+1$, factors of the firſt degree each of which only enters once into the propoſed function; it will therefore be neceſſary, when we employ the factors of the ſecond degree, to reject the firſt and laſt, and take inſtead of them

$$(y-1)(y+1)=y^2-1.$$

The factors of the firſt degree of the function y^5-1 are

$$y-1,$$

$$y-\left(\text{cof.}\frac{2\pi}{5}\pm\sqrt{-1}\,\text{ſin.}\frac{2\pi}{5}\right)$$

$$y-\left(\text{cof.}\frac{4\pi}{5}\pm\sqrt{-1}\,\text{ſin.}\frac{4\pi}{5}\right)$$

Thoſe of the ſecond degree are

$$y^2-2y+1,$$

$$y^2-2y\,\text{cof.}\frac{2\pi}{5}+1,$$

$$y^2-2y\,\frac{\text{cof.}\,4\pi}{5}+1;$$

but it is to be obſerved that the firſt factor of the ſecond degree is the ſquare of $y-1$, which enters only once into the propoſed function.

123. When the function to be decompoſed into factors is y^n+1, the formula

$$y=\text{cof.}\frac{(2m+1)\pi}{n}+\sqrt{-1}\,\text{ſin.}\frac{(2m+1)\pi}{n},$$

which correſponds to that caſe (§ 121.) is alſo ſuſceptible of the double ſign $\pm$, provided we ſtop at the value of m which gives

$$2m+1=n,\ \text{or}\ 2m+1=n-1,$$

according as n is odd or even; hence it follows that

$$m=\frac{n-1}{2},\quad m=\frac{n-2}{2};$$

the factors of the firſt degree are

$$y-\left(\text{cof.}\frac{(2m+1)\pi}{n}\pm\sqrt{-1}\,\text{ſin.}\frac{(2m+1)\pi}{n}\right),$$

and thoſe of the ſecond

$$y^2-2y\,\text{cof.}\frac{(2m+1)\pi}{n}+1.$$

When among theſe laſt there is found ſome which are ſquares, we muſt take only one of their ſimple factors, in the ſame way as in the two preceding examples.

When the function is y^5+1, the factors of the firſt degree are

$$y-\left(\text{cof.}\frac{\pi}{5}\pm\sqrt{-1}\,\text{ſin.}\frac{\pi}{5}\right),$$

$$y-\left(\text{cof.}\frac{3\pi}{5}\pm\sqrt{-1}\,\text{ſin.}\frac{3\pi}{5}\right)$$

$$y+1;$$

and thoſe of the ſecond,

$$y^2-2y\cos.\frac{\pi}{5}+1,$$

$$y^2-2y\cos.\frac{3\pi}{5}+1,$$

$$y^2+2y+1.$$

The function y^6+1 has for factors of the firſt degree

$$y-\left(\cos.\frac{\pi}{6}\pm\sqrt{-1}\sin.\frac{\pi}{6}\right),$$

$$y-\left(\cos.\frac{3\pi}{6}\pm\sqrt{-1}\sin.\frac{3\pi}{6}\right),$$

$$y-\left(\cos.\frac{5\pi}{6}\pm\sqrt{-1}\sin.\frac{5\pi}{6}\right),$$

and thoſe of the ſecond,

$$y^2-2y\cos.\frac{\pi}{6}+1,$$

$$y^2-2y\cos.\frac{3\pi}{6}+1, \text{ or } y^2+1,$$

$$y^2-2y\cos.\frac{5\pi}{6}+1.$$

124. Such functions as are of this form $x^{2n}+2px^n+q$ may be treated in the ſame manner as thoſe which conſiſt of only two terms. By putting the function $=0$, and reſolving the equation which is thus produced, in the ſame manner as if it were of the ſecond degree, we find the factors to be

$$x^n+\left(p\pm\sqrt{(p^2-q)}\right);$$

if p^2 exceed q, the ſecond term of theſe factors is real, and by making

$$\pm a^n=p\pm\sqrt{(p^2-q)},$$

we have functions of the form

$$x\pm a^n$$

to decompoſe into factors.

When $p^2<q$, then we put $p=a^n$, $q=b^{2n}$, $x=by$, and the function becomes

$$b^{2n}y^{2n}+2a^nb^ny^n+b^{2n}$$

$$=b^{2n}\left(y^{2n}+\frac{2a^n}{b^n}y^n+1\right);$$

but the condition $p^2<q$, or $a^{2n}<b^{2n}$, makes $a^n<b^n$, and $\frac{a^n}{b^n}<1$, therefore $\frac{a^n}{b^n}$ may be repreſented by the coſine of a given arch δ, and the propoſed function will be reduced to

$$b^{2n}(y^{2n}+2y^n\cos.\delta+1),$$

we have then only to reſolve the equation

$$y^{2n}+2y^n\cos.\delta+1=0,$$

and we immediately find

$$y^n=-\cos.\delta\pm\sqrt{-1}\sin.\delta;$$

we now aſſume as in § 121,

$$y=\cos.z\pm\sqrt{-1}\sin.z;$$

then we find (§ 120),

$$y^n=\cos.nz\pm\sqrt{-1}\sin.nz$$

which expreſſion for y^n, being compared with its other value, gives

$$\cos.nz=\cos.\delta,\ \sin.nz=\sin.\delta.$$

Theſe relations will be ſatisfied if we ſuppoſe $nz=2m\pi+\delta$, m being any whole number whatever, for

$$\cos.(2m\pi+\delta)=\cos.\delta,\ \sin.(2m\pi+\delta)=\sin.\delta;$$

we have therefore

$$z=\frac{2m\pi+\delta}{n},$$

$$y=\cos.\frac{2m\pi+\delta}{n}\pm\sqrt{-1}\sin.\frac{2m\pi+\delta}{n}.$$

The factors of the firſt degree of the function

$$y^{2n}+2y^n\cos.\delta+1$$

will conſequently be comprehended in this formula

$$y-\left\{\cos.\frac{2m\pi+\delta}{n}\pm\sqrt{-1}\sin.\frac{2m\pi+\delta}{n}\right\}$$

If p the coefficient of the ſecond term of the propoſed function be negative, the only change neceſſary is to make $p=-a^n$, and to take the arch δ greater than a quadrant.

Of the Fluents of Irrational Functions.

125. When a fluxionary expreſſion involves irrational functions, we muſt endeavour either to transform it into another that is rational, or to reduce it to a ſeries of irrational terms of this form $Ax^{\frac{m}{n}}\dot{x}$, and then, in either caſe its fluent may be found by the rules already delivered.

Let us take for example the fluxion $\frac{(1+\sqrt{x}-\sqrt[3]{x^2})\dot{x}}{1+\sqrt[3]{x}}$. It is evident that by putting $x=z^6$, all the extractions indicated by the radical ſigns may be effected, and the fluxion may be transformed to $\frac{6z^5(1+z^3-z^4)\dot{z}}{1+z^2}$, which, by dividing the numerator by $1+z^2$, may be otherwiſe expreſſed thus,

$$-6\left(z^7\dot{z}-z^6\dot{z}-z^5\dot{z}+z^4\dot{z}-z^3\dot{z}+\dot{z}-\frac{\dot{z}}{1+z^2}\right)$$

The fluent of which is

$$-6\left\{\frac{z^8}{8}-\frac{z^7}{7}-\frac{z^6}{6}+\frac{z^5}{5}-\frac{z^3}{3}\right\}+z-\text{arc }(\tan.=z)\Big\}+\textit{conſt.}$$

126.

126. We ſhall firſt conſider ſuch fluxions as contain the irrational function $\sqrt{(A+Bx+Cx^2)}$, and which have neceſſarily one or other of theſe forms

$$X\dot{x}\sqrt{(A+Bx+Cx^2)},\ \frac{X\dot{x}}{\sqrt{(A+Bx+Cx^2)}},$$

X being put for any rational function of x; and it may be remarked, that the latter form comprehends the former, which may be written thus

$$\frac{X\dot{x}\sqrt{(A+Bx+Cx^2)}\times\sqrt{(A+Bx+Cx^2)}}{\sqrt{(A+Bx+Cx^2)}}$$
$$=\frac{X(A+Bx+Cx^2)\dot{x}}{\sqrt{(A+Bx+Cx^2)}};$$

and here the numerator of the fluxion is a rational function of x.

Before we transform the expreſſion $\sqrt{(A+Bx+Cx^2)}$ into another that is rational with reſpect to the variable quantity it contains, we ſhall put the quantity $A+Bx+Cx^2$ under this form

$$C\left(\frac{A}{C}+\frac{B}{C}x+x^2\right);$$

and, in order to abridge, we ſhall put

$$C=c^2,\ \frac{A}{C}=a,\ \frac{B}{C}=b,$$

then we have

$$\sqrt{(A+Bx+Cx^2)}=c\sqrt{(a+bx+x^2)},$$

Let us now aſſume $\sqrt{(a+bx+x^2)}=x+z$, then, ſquaring both ſides of the equation, we find $a+bx=2xz+z^2$, hence we get $x=\frac{a-z^2}{2z-b}$, and conſequently

$$\sqrt{(A+Bx+Cx^2)}=c(x+z)=c\left(\frac{a-bz+z^2}{2z-b}\right)$$
$$\dot{x}=-\frac{2(a-bz+z^2)\dot{z}}{(2z-b)^2}.$$

By means of theſe values the fluxion $\frac{X\dot{x}}{\sqrt{(A+Bx+Cx^2)}}$ is transformed into another fluxion $Z\dot{z}$, where Z denotes a rational function of z, which is real when C or c^2 is poſitive; but as when C is negative c becomes imaginary, the fluxion $Z\dot{z}$ which involves c becomes alſo imaginary.

In this caſe we have to conſider $\sqrt{(A+Bx-Cx^2)}$, and making

$$C=c^2,\ \frac{A}{C}=a,\ \frac{B}{C}=b,$$

it becomes $c\sqrt{(a+bx-x^2)}$. The quantity x^2-bx-a may always be decompoſed into real factors of the firſt degree; let us repreſent theſe factors by $x-\alpha$, and $x-\alpha'$, then it is evident that

$$a+bx-x^2=-(x^2-bx-a)$$
$$=(x-\alpha)(\alpha'-x).$$

Let us now aſſume

$$\sqrt{(x-\alpha)(\alpha'-x)}=(z-x)z.$$

then, ſquaring both ſides of the equation it becomes diviſible by $x-\alpha$, and we have $\alpha'-\alpha=(x-\alpha)z^2$, from which we find

$$x=\frac{\alpha z^2+\alpha'}{z^2+1},\ (x-\alpha)z=\frac{(\alpha'-\alpha)z}{z^2+1},$$
$$\dot{x}=\frac{2(\alpha-\alpha')z\dot{z}}{(z^2+1)^2},$$

values which render the propoſed fluxion $\frac{X\dot{x}}{\sqrt{(A+Bx-Cx^2)}}$ rational.

127. Let us now take for example the fluxion $\frac{\dot{x}}{\sqrt{(A+Bx+Cx^2)}}$; by applying to it the firſt of the preceding transformations it becomes $\frac{-2\dot{z}}{c(2z-b)}$, the fluent of which is $-\frac{1}{c}$ l. $(2z-b)+$ *conſt.* Subſtituting now for z its value $-x+\sqrt{(a+bx+x^2)}$, and for a, b, and c, the quantities they ſeverally repreſent, the fluent becomes

$$\frac{-1}{\sqrt{C}}\text{ l.}\left\{\frac{1}{\sqrt{C}}\left(\begin{matrix}-\frac{B}{\sqrt{C}}-2x\sqrt{C}\\+2\sqrt{(A+Bx+Cx^2)}\end{matrix}\right)\right\}+\textit{conſt.}$$

a reſult to which we may alſo give this form

$$\frac{-1}{\sqrt{C}}\text{ l.}\left\{\begin{matrix}\frac{-B}{2\sqrt{C}}-x\sqrt{C}\\+\sqrt{(A+Bx+Cx^2)}\end{matrix}\right\}$$
$$+\text{ l.}\frac{2}{\sqrt{C}}+\textit{conſt.}$$

By uniting the conſtant quantities into one, and obſerving that the radical quantity $\sqrt{C}$ may have the ſign $\pm$ prefixed to it, we have at laſt

$$\int\frac{\dot{x}}{\sqrt{(A+Bx+Cx^2)}}\text{ equal to}$$
$$\frac{1}{\sqrt{C}}\text{ l.}\left\{+\frac{B}{2\sqrt{C}}+x\sqrt{C}+\sqrt{(A+Bx+Cx^2)}\right\}$$
$$+\text{ conſt.}$$

128. Let us take for the ſecond example $\frac{\dot{x}}{\sqrt{(A+Bx-Cx^2)}}$. By employing the latter transformation of § 126 we have $\frac{-2\dot{z}}{c(z^2+1)}$, of which the fluent is

$$-\frac{2}{c}\text{ arc }(\text{tan.}=z)+\textit{conſt.}$$

Subſtituting now inſtead of z its value $\frac{\sqrt{(\alpha'-x)}}{\sqrt{(x-\alpha)}}$ deduced from the equation $\alpha'-x=(x-\alpha)z^2$,

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and putting $\sqrt{C}$ for c, we get $\int \frac{\dot{x}}{\sqrt{(A+Bx-Cx^2)}}$ equal to

$$-\frac{2}{\sqrt{C}} \text{ arc } \left(\text{tan.} = \frac{\sqrt{(\alpha'-x)}}{\sqrt{(x-\alpha)}}\right) + \textit{conſt.}$$

α and α' being the roots of the equation

$$x^2 - \frac{B}{C}x - \frac{A}{C} = 0.$$

Let us ſuppoſe that $A=C=1$ and $B=0$, then the propoſed fluxion becomes in this particular caſe $\frac{\dot{x}}{\sqrt{(1-x^2)}}$, and the preceding formula gives for its fluent -2 arc. $\left(\text{tan.} = \frac{\sqrt{(1-x)}}{\sqrt{(1+x)}}\right) + \textit{conſt.}$ for α and α' being the roots of the equation $x^2-1=0$, we muſt take $\alpha=-1$; and $\alpha'=1$.

We may, however, give this fluent another form by proceeding thus; Let v be the arch whoſe tan. $= \frac{\sqrt{(1-x)}}{\sqrt{(1+x)}}$, then $\text{tan.}^2 v = \frac{1-x}{1+x}$, and $x = \frac{1-\text{tan.}^2 v}{1+\text{tan.}^2 v}$ $= \frac{2}{1+\text{tan.}^2 v} - 1 = \frac{2}{\text{ſec.}^2 v} - 1 = 2\,\text{coſ.}^2 v - 1$, but $2\,\text{coſ.}^2 v - 1 = \text{coſ.}\ 2v$ (ALGEBRA, § 358.) therefore, $x = \text{coſ.}\ 2v$. Put s for the arch whoſe ſine is x, and π for half the circumference, then $x = \text{coſ.}\ (\frac{1}{2}\pi - s)$, therefore $2v = \frac{1}{2}\pi - s$, and ſince it has been ſhewn that $\int \frac{\dot{x}}{\sqrt{(1-x^2)}} = -2v + \textit{conſt.}$ therefore $\int \frac{\dot{x}}{\sqrt{(1-x^2)}}$ $= s - \frac{1}{2}\pi + \textit{conſt.}$ or, by including the arch $\frac{1}{2}\pi$ in the conſtant quantity, $\int \frac{\dot{x}}{\sqrt{(1-x^2)}} = s + \textit{conſt.}$ This concluſion agrees with what has been ſhewn in § 59.

Inſtead of finding the fluent of

$$\frac{\dot{x}}{\sqrt{(A+Bx-Cx^2)}} = \frac{\dot{x}}{c\sqrt{(a+bx-x^2)}}$$

by firſt transforming it to a rational expreſſion, we may reduce it directly to an arch of a circle by proceeding as follows. Put $x - \frac{b}{2} = z$, then $\dot{x} = \dot{z}$, and the fluxion is transformed to $\frac{\dot{z}}{c\sqrt{(a+\frac{1}{4}b^2-z^2)}}$; again, put $a+\frac{1}{4}b^2 = g^2$, and $z = gu$, then $\dot{z} = g\dot{u}$, and this laſt fluxion is transformed to $\frac{\dot{u}}{c\sqrt{(1-u^2)}}$, the fluent of which is $\frac{1}{c}$ arc $(\text{ſin.} = u) + \textit{conſt.}$

Of the Fluents of Binomial Fluxions.

129. Let us now conſider ſuch fluxions as have this form

$$x^{m-1}\,\dot{x}\,(a+bx^n)^{\frac{p}{q}},$$

and which are ſometimes called *binomial* fluxions. We may here ſuppoſe m and n to be whole numbers, without affecting the generality of the expreſſion. Inverſe Method.

For if we had $x^{\frac{1}{2}}\,\dot{x}\,(a+bx^{\frac{1}{2}})^{\frac{p}{q}}$, we may aſſume $x=z^6$, then $\dot{x} = 6z^5\dot{z}$, and the fluxion becomes $6z^7\,\dot{z}\,(a+bz^3)^{\frac{p}{q}}$. We may alſo ſuppoſe n to be poſitive, for if it were negative, ſo that the fluxion were $x^{m-1}\,\dot{x}\,(a+bx^{-n})^{\frac{p}{q}}$ we have only to aſſume $x = \frac{1}{z}$, and the fluxion is transformed to $-z^{-m-1}\,\dot{z}\,(a+bz^n)^{\frac{p}{q}}$.

Let us inquire in what caſe the fluxion $x^{m-1}\,\dot{x}\,(a+bx^n)^{\frac{p}{q}}$ may become rational. Aſſume $a+bx^n = z^q$, then $(a+bx^n)^{\frac{p}{q}} = z^p$, $x^n = \frac{z^q-a}{b}$, $x^m = \left(\frac{z^q-a}{b}\right)^{\frac{m}{n}}$, and $x^{m-1}\,\dot{x} = \frac{q}{nb}z^{q-1}\left(\frac{z^q-a}{b}\right)^{\frac{m}{n}-1}\dot{z}$; hence the propoſed fluxion is transformed to

$$\frac{q}{nb}\,z^{p+q-1}\,\dot{z}\left(\frac{z^q-a}{b}\right)^{\frac{m}{n}-1};$$

this expreſſion is evidently rational as often as $\frac{m}{n}$ is a whole number.

There are yet other caſes in which the fluxion may become rational, and which may be determined by aſſuming $a+bx^n = x^n u^q$, thus we have

$$x = \frac{a}{u^q-b},\ x^m = \frac{a^{\frac{m}{n}}}{(u^q-b)^{\frac{m}{n}}},\ \ldots\ldots$$

$$x^{m-1}\,\dot{x} = \frac{-q\,a^{\frac{m}{n}}\,u^{q-1}\,\dot{u}}{n\,(u^q-b)^{\frac{m}{n}+1}}, \text{ and becauſe that } (a+bx^n)^{\frac{p}{q}}$$

$$= \frac{a^{\frac{p}{q}}\,u^p}{(u^q-b)^{\frac{p}{q}}} \text{ the fluxion } x^{m-1}\,\dot{x}\,(a+bx^n)^{\frac{p}{q}} \text{ is tranſformed to}$$

$$\frac{-q\,a^{\frac{m}{n}+\frac{p}{q}}\,u^{p+q-1}\,\dot{u}}{n\,(u^q-b)^{\frac{m}{n}+\frac{p}{q}+1}},$$

an expreſſion which is rational if $\frac{m}{n}+\frac{p}{q}$ is a whole number.

130. As it is not poſſible, in every caſe, to expreſs in finite terms the formula $\int x^{m-1}\,\dot{x}\,(a+bx^n)^{\frac{p}{q}}$, we may try to reduce it to its moſt ſimple caſe, as we have done

Inverſe Method.

done with reſpect to $\int \frac{\dot{z}}{(z^2+s^2)^{\frac{1}{2}}}$ in § 114, which we have ſucceeded in reducing to $\int \frac{\dot{z}}{z^2+s^2}$. To effect this reduction, we remark, that, ſince when u and v denote any functions of a variable quantity, the fluxion of uv is $u\dot{v}+v\dot{u}$, (§ 37.) therefore $\int u\dot{v}=uv-\int v\dot{u}$. Now if we can decompoſe the expreſſion $x^{m-1}\dot{x}(a+bx^n)^{\frac{p}{q}}$ into two factors ſuch, that we can find the fluent of one of them, then, denoting that factor by $\dot{v}$, and the other by u, the fluent of the propoſed fluxion will be made to depend on that of $v\dot{u}$, which in ſome caſes will be more ſimple than the propoſed fluxion. That we may abridge a little the reſults, we ſhall write p inſtead of $\frac{p}{q}$, ſo that p will repreſent any fraction; the propoſed fluxion thus ſimplified in its form is

$$x^{m-1}\dot{x}(a+bx^n)^p.$$

Among the different ways of reſolving this fluxion into two factors, we ſhall chooſe that which diminiſhes the exponent of x without the parentheſes, we therefore write the fluxion thus

$$x^{m-n}\times x^{n-1}\dot{x}(a+bx^n)^p,$$

now the fluent of the factor $x^{n-1}\dot{x}(a+bx^n)^p$ may always be determined, whatever be the value of p, by § 108; let us denote this factor by $\dot{v}$, then

$$v=\frac{(a+bx^n)^{p+1}}{(p+1)nb}, \text{ and } u=x^{m-n},$$

thus the formula $\int u\dot{v}=uv-\int v\dot{u}$ gives us $\int x^{m-1}\dot{x}(a+bx^n)^p$ equal to

$$\frac{x^{m-n}(a+bx^n)^{p+1}}{(p+1)nb}$$

$$-\frac{m-n}{(p+1)nb}\int x^{m-n-1}\dot{x}(a+bx^n)^{p+1}.$$

But $\int x^{m-n-1}\dot{x}(a+bx^n)^{p+1}=$

$$\int x^{m-n-1}\dot{x}(a+bx^n)^p(a+bx^n)=$$

$$a\int x^{m-n-1}\dot{x}(a+bx^n)^p$$

$$+b\int x^{m-1}\dot{x}(a+bx^n)^p;$$

Subſtituting now this laſt value in the preceding equation, and collecting into one the terms involving the fluent $\int x^{m-1}\dot{x}(a+bx^n)^p$, we find

$$\left(1+\frac{m-n}{(p+1)n}\right)\int x^{m-1}\dot{x}(a+bx^n)^p=$$

Inverſe Method.

$$\frac{1}{(p+1)nb}\left\{\begin{matrix}x^{m-n}(a+bx^n)^{p+1}\\-a(m-n)\int x^{m-n-1}\dot{x}(a+bx^n)^p\end{matrix}\right\}$$

hence at laſt we get

$$(A)$$

$$\int x^{m-1}\dot{x}(a+bx^n)^p=$$

$$\frac{1}{b(pn+m)}\left\{\begin{matrix}x^{m-n}(a+bx^n)^{p+1}\\-a(m-n)\int x^{m-n-1}\dot{x}(a+bx^n)^p\end{matrix}\right\}$$

It is eaſy to ſee that, as we have, by this formula, reduced the determination of the fluent of $x^{m-1}\dot{x}(a+bx^n)^p$ to that of $x^{m-n-1}\dot{x}(a+bx^n)^p$ we may reduce this laſt to that of $x^{m-2n-1}\dot{x}(a+bx^n)^p$ by writing $m-n$ in place of m in equation (A), then by changing m into $m-2n$ we may reduce the fluent of $x^{m-2n-1}\dot{x}(a+bx^n)^p$ to that of $x^{m-3n-1}\dot{x}(a+bx^n)^p$, and ſo on.

In general, if r denote the number of reductions, we ſhall at laſt come to

$\int x^{m-rn-1}\dot{x}(a+bx^n)^p$, and the laſt formula will be

$$\int x^{m-(r-1)n-1}\dot{x}(a+bx^n)^p=$$

$$\frac{x^{m-rn}(a+bx^n)^{p+1}}{b(pn+m-(r-1)n)}$$

$$-\frac{a(m-rn)\int x^{m-rn-1}\dot{x}(a+bx^n)^p}{b(pn+m-(r-1)n)}.$$

It appears by this laſt formula, that if m is a multiple of n, then $\int x^{m-1}\dot{x}(a+bx^n)^p$ will be an algebraic quantity, for in that caſe the coefficient $m-rn$ will be $=0$, and therefore the term containing $\int x^{m-rn-1}\dot{x}(a+bx^n)^p$ will vaniſh. This reſult coincides with what we have already found, § 129.

131. We may alſo obtain a reduction, by which the exponent p ſhall be diminiſhed by unity. For this purpoſe it is ſufficient to obſerve that $\int x^{m-1}\dot{x}(a+bx^n)^p$ is equal to

$$\int x^{m-1}\dot{x}(a+bx^n)^{p-1}(a+bx^n)=$$

$$a\int x^{m-1}\dot{x}(a+bx^n)^{p-1}$$

$$+b\int x^{m+n-1}\dot{x}(a+bx^n)^{p-1},$$

and that the formula (A) by changing m into $m+n$, and p into $p-1$ gives

$$\int x^{m+n-1}\,\dot{x}\,(a+bx^n)^{p-1} =$$

$$\frac{x^m\,(a+bx^n)^p - am\int x^{m-1}\,\dot{x}\,(a+bx^n)^{p-1}}{b\,(pn+m)}.$$

Subſtitute now this value in the preceding equation, we have

(B)

$$\int {}^{m-1}\,\dot{x}\,(a+bx^n)^p =$$

$$\frac{x^m\,(a+bx^n)^p + pna\int x^{m-1}\,\dot{x}\,(a+bx^n)^{p-1}}{pn+m}.$$

By means of this general formula we may take away ſucceſſively from p as many units as it contains, and by the application of this formula, and formula (A), we may cauſe the fluent $\int x^{m-1}\,\dot{x}\,(a+bx^n)^p$ to depend on $\int x^{m-rn-1}\,\dot{x}\,(a+bx^n)^{p-s}$, rn being the greateſt multiple of r contained in $m-1$, and s the greateſt whole number contained in p.

The fluent $\int x^7\,\dot{x}\,(a+bx^3)^{\frac{5}{2}}$, for example, may, by the application of formula (A) be reduced ſucceſſively to

$$\int x^4\,\dot{x}\,(a+bx^3)^{\frac{5}{2}}, \text{ and } \int \dot{x}\,x\,(a+bx^3)^{\frac{5}{2}},$$

and by formula (B) $\int x\,\dot{x}\,(a+bx^3)^{\frac{5}{2}}$ is reduced ſucceſſively to

$$\int \dot{x}\,x\,(a+bx^3)^{\frac{3}{2}}, \text{ \& } \int \dot{x}\,x\,(a+bx^3)^{\frac{1}{2}}.$$

132. It is evident, that if m and n were negative, the formulas (A) and (B) would not anſwer the purpoſe for which they have been inveſtigated, becauſe, in that caſe they would increaſe the exponents inſtead of diminiſhing them. If, however, we reverſe them, we ſhall find that they then apply to the caſe under conſideration.

From formula (A) we get

$$\int x^{m-n-1}\,\dot{x}\,(a+bx^n)^p =$$

$$\frac{x^{m-n}\,(a+bx^n)^{p+1}}{a\,(m-n)}$$

$$-\frac{b\,(m+np)\int x^{m-1}\,\dot{x}\,(a+bx^n)^p}{a\,(m-n)};$$

Subſtitute now $m+n$ in place of m, and it becomes

(C)

$$\int x^{m-1}\,\dot{x}\,(a+bx^n)^p =$$

$$\frac{x^m\,(a+bx^n)^{p+1}}{am}$$

$$-\frac{b\,(m+n+np)\int x^{m+n-1}\,\dot{x}\,(a+bx^n)^p}{am}.$$

This formula diminiſhes the exponents without the parentheſes, becauſe $m+n-1$ becomes $-m+n-1$, when $-m$ is ſubſtituted inſtead of m.

To reverſe formula (B) we firſt take

$$\int x^{m-1}\,\dot{x}\,(a+bx^n)^{p-1} =$$

$$\frac{-x^m\,(a+bx^n)^p}{pna}$$

$$+\frac{(m+np)\int x^{m-1}\,\dot{x}\,(a+bx^n)^p}{pna};$$

Then, writing $p+1$ inſtead of p, we find

(D)

$$\int x^{m-1}\,\dot{x}\,(a+bx^n)^p =$$

$$-\frac{x^m\,(a+bx^n)^{p+1}}{(p+1)\,na}$$

$$+\frac{(m+n+np)\int x^{m-1}\,\dot{x}\,(a+bx^n)^{p+1}}{(p+1)\,na}.$$

This formula anſwers the purpoſe we have in view, becauſe $p+1$ becomes $-p+1$ when p is negative.

Theſe formulas (A), (B), (C), (D) are inapplicable when their denominators vaniſh. This is the caſe with formula (A); for example, when $m=-np$; but, in every ſuch caſe the propoſed fluxion may have its fluent determined either algebraically or by logarithms.

133. Let the fluent be $\int \frac{x^{m-1}\,\dot{x}}{\sqrt{(1-x^2)}}$, m being a whole poſitive number. Formula (A) immediately applies to this caſe, ſo that by putting $a=1$, $b=-1$, $n=2$, $p=-\frac{1}{2}$ we have

$$\int \frac{x^{m-1}\,\dot{x}}{\sqrt{(1-x^2)}} = \begin{cases} -\dfrac{x^{m-2}\sqrt{(1-x^2)}}{m-1} \\ +\dfrac{m-2}{m-1}\displaystyle\int \frac{x^{m-3}\,\dot{x}}{\sqrt{(1-x^2)}} \end{cases}$$

or, ſubſtituting m in place of $m-1$,

$$\int \frac{x^m\,\dot{x}}{\sqrt{(1-x^2)}} = \begin{cases} -\dfrac{x^{m-1}\sqrt{(1-x^2)}}{m} \\ +\dfrac{m-1}{m}\displaystyle\int \frac{x^{m-2}\,\dot{x}}{\sqrt{(1-x^2)}} \end{cases}$$

Let us ſuppoſe, for example, that $m=1$, then

$$\int \frac{x\,\dot{x}}{\sqrt{(1-x^2)}} = -\sqrt{(1-x^2)} + \textit{conſt.}$$

Let us next ſuppoſe that $m=3$, then

$$\int \frac{x^3\,\dot{x}}{\sqrt{(1-x^2)}} = \begin{cases} -\frac{1}{3}x^2\sqrt{(1-x^2)} \\ +\frac{2}{3}\int \frac{x\,\dot{x}}{\sqrt{(1-x^2)}} \end{cases}$$

or, ſubſtituting for $\int \frac{x\,\dot{x}}{\sqrt{(1-x^2)}}$ its value,

$$\int \frac{x\,\dot{x}}{\sqrt{(1-x^2)}} = -\left(\frac{1}{3}x^2+\frac{2}{3}\right)\sqrt{(1-x^2)} + \textit{conſt.}$$

If we ſuppoſe $m=2$, then

$$\int \frac{x^2\,\dot{x}}{\sqrt{(1-x^2)}} = \begin{cases} -\frac{1}{2}x\sqrt{(1-x^2)} \\ +\frac{1}{2}\int \frac{\dot{x}}{\sqrt{(1-x^2)}} \end{cases}$$

But we have already found, § 128. that

$$\int \frac{\dot{x}}{\sqrt{(1-x^2)}} = \text{arc (ſin.}=x),$$

therefore, putting A for arc (ſin. $=x$),

$$\int \frac{x^2\,\dot{x}}{\sqrt{(1-x^2)}} = -\frac{1}{2}x\sqrt{(1-x^2)} + \frac{1}{2}\,\text{A} + \textit{conſt.}$$

In the very ſame way we find that

$$\int \frac{x^4\,\dot{x}}{\sqrt{(1-x^2)}} \text{ is equal to}$$

$$-\left(\frac{1}{4}x^3+\frac{3}{8}x\right)\sqrt{(1-x^2)} + \frac{3}{8}\,\text{A} + \textit{conſt.}$$

134. In the caſe of m, a negative number, we muſt have recourſe to formula (C), from which we find

$$\int \frac{x^{-m-1}\,\dot{x}}{\sqrt{(1-x^2)}} = \begin{cases} -\frac{x^{-m}\sqrt{(1-x^2)}}{m} \\ +\frac{m-1}{m}\int \frac{x^{-m+1}\,\dot{x}}{\sqrt{(1-x^2)}} \end{cases}$$

which formula, by writing $-m$ inſtead of $-m-1$ becomes

$$\int \frac{\dot{x}}{x^m\sqrt{(1-x^2)}} = \begin{cases} -\frac{\sqrt{(1-x^2)}}{(m-1)\,x^{m-1}} \\ +\frac{m-2}{m-1}\int \frac{\dot{x}}{x^{m-2}\sqrt{(1-x^2)}} \end{cases}$$

We cannot here ſuppoſe $m=1$, for that value would render the denominator $=0$; therefore, before we can apply this formula, it is neceſſary to inveſtigate the fluent of $\frac{\dot{x}}{x\sqrt{(1-x^2)}}$. We may eaſily find it from § 126, or otherwiſe thus, put $1-x^2=z^2$, then

$$x=\sqrt{(1-z^2)},\quad \dot{x}=\frac{-z\,\dot{z}}{\sqrt{(1-z^2)}}$$

Therefore

$$\frac{\dot{x}}{x\sqrt{(1-x^2)}} = \frac{-\dot{z}}{1-z^2} = \frac{-\frac{1}{2}\dot{z}}{1+z} + \frac{\frac{1}{2}\dot{z}}{1-z}.$$

The fluent of the right hand ſide of this equation is evidently (§ 103.)

$$-\tfrac{1}{2}\text{l.}(1+z)+\tfrac{1}{2}\text{l.}(1-z) = -\tfrac{1}{2}\text{l.}\left(\frac{1+z}{1-z}\right);$$

or, ſince $\frac{1+z}{1-z}=\frac{(1+z)^2}{1-z^2}$, the ſame fluent may be expreſſed thus

$$-\tfrac{1}{2}\text{l.}\,\frac{(1+z)^2}{1-z^2} = -\text{l.}\,\frac{1+z}{\sqrt{(1-z^2)}}.$$

therefore, by ſubſtituting $\sqrt{(1-x^2)}$ for z, and x for $\sqrt{(1-z^2)}$ we have

$$\int \frac{\dot{x}}{x\sqrt{(1-x^2)}} = -\text{l.}\left(\frac{1+\sqrt{(1-x^2)}}{x}\right) + \textit{conſt.}$$

If we ſuppoſe $m=2$, the formula becomes

$$\int \frac{\dot{x}}{x^2\sqrt{(1-x^2)}} = -\frac{\sqrt{(1-x^2)}}{x} + \textit{conſt.}$$

If we ſuppoſe $m=3$, then

$$\int \frac{\dot{x}}{x^3\sqrt{(1-x^2)}} = \begin{cases} -\frac{\sqrt{(1-x^2)}}{2x^2} \\ +\frac{1}{2}\int \frac{\dot{x}}{x\sqrt{(1-x^2)}} \end{cases}$$

which expreſſion, by ſubſtituting for

$$\int \frac{\dot{x}}{x\sqrt{(1-x^2)}} \text{ its value, becomes}$$

$$\int \frac{\dot{x}}{x^3\sqrt{(1-x^2)}} = \begin{cases} -\frac{\sqrt{(1-x^2)}}{2x^2} \\ -\frac{1}{2}\text{l.}\left(\frac{1+\sqrt{(1-x^2)}}{x}\right) \\ +\textit{conſt.} \end{cases}$$

Of Finding Fluents by Series.

135. We can always eaſily find an expreſſion for the fluent $\int X\dot{x}$, where X denotes any function of x; when that function is expanded into a ſeries, each term of which is ſome power of x multiplied by a conſtant quantity; thus ſuppoſe

$$X = A\,x^m + B\,x^{m+n} + C\,x^{m+2n} + \&c.$$

then $X\dot{x}$ is equal to

$$A\,x^m\dot{x}+B\,x^{m+n}\dot{x}+C\,x^{m+2n}\dot{x}+\&c.$$

and taking the fluent of each term by § 101,

$$\int X\dot{x}=\frac{A\,x^{m+1}}{m+1}+\frac{B\,x^{m+n+1}}{m+n+1}$$

$$+\frac{C\,x^{m+2n+1}}{m+2n+1}+\&c.+\textit{conſt.}$$

If in the developement of x there be any term of this form $\frac{A}{x}$, the fluent correſponding to that term will be $A\,l.\,x$ (§ 103).

136. The moſt ſimple function of x that can be expanded into a ſeries is $\frac{1}{a+x}$, which becomes,

$$\frac{1}{a}-\frac{x}{a^2}+\frac{x^2}{a^3}-\frac{x^3}{a^4}+\&c.$$

Hence we find

$$\frac{\dot{x}}{a+x}=\frac{\dot{x}}{a}-\frac{x\dot{x}}{a^2}+\frac{x^2\dot{x}}{a^3}-\frac{x^3\dot{x}}{a^4}+\&c.$$

and taking the fluents

$$\int\frac{\dot{x}}{a+x}=\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\frac{x^4}{4a^4}+\&c.$$
$$+\textit{conſt.}$$

Now we know that $\int\frac{\dot{x}}{a+x}=l.\,(a+x)$ (§ 57.) therefore

$$l.\,(a+x)=\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\frac{x^4}{4a^4}+\&c.$$
$$+\textit{conſt.}$$

To find the value of the conſtant quantity we have only to make $x=0$, for then the equation becomes $l.\,a=\textit{conſt.}$ therefore

$$l.\,(a+x)=l.\,a+\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\&c.$$

hence, if we ſubtract $l.\,a$ from each ſide, and obſerve that $l.\,(x+a)-l.\,a=l.\left(\frac{x+a}{a}\right)=l.\left(1+\frac{x}{a}\right)$ we get

$$l.\left(1+\frac{x}{a}\right)=\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\frac{x^4}{4a^4}+\&c.$$

From this concluſion we may deduce rules for computing the logarithms of numbers.

137. Let the fluxion be $\frac{a\dot{x}}{a^2+x^2}$, which may be put under this form $\frac{\frac{\dot{x}}{a}}{1+\frac{x^2}{a^2}}$, and which conſequently belongs to the arch of which the tangent$=\frac{x}{a}$ (§ 60). By reducing $\frac{a}{a^2+x^2}$ into a ſeries, we find

$$\frac{a}{a^2+x^2}=\frac{1}{a}-\frac{x^2}{a^3}+\frac{x^4}{a^5}-\frac{x^6}{a^7}+\&c.$$

Hence, multiply both ſides by $\dot{x}$, and taking the fluent of each term, we get

$$\int\frac{a\dot{x}}{a^2+x^2}=\text{arc}\left(\text{tan.}=\frac{x}{a}\right)+\textit{conſt.}=$$

$$\frac{x}{a}-\frac{x^3}{3a^3}+\frac{x^5}{5a^5}-\frac{x^7}{7a^7}+\&c.+\textit{conſt.}$$

If we wiſh to deduce from this equation, the value of the leaſt arch whoſe tangent is $\frac{x}{a}$ it is neceſſary to ſuppreſs the arbitrary conſtant quantity, for when that arch $=0$, then $x=0$, thus we have the arch whoſe tangent is $\frac{x}{a}$ expreſſed by the infinite ſeries

$$\frac{x}{a}-\frac{x^3}{3a^3}+\frac{x^5}{5a^5}-\frac{x^7}{7a^7}+\&c.$$

Let π denote the circumference of a circle whoſe diameter is unity, or half the circumference of a circle whoſe radius is unity, then, as the ſine of 30 degrees, or $\frac{1}{6}\pi$, is $\frac{1}{2}$, and its coſine $\sqrt{\ }(1-\frac{1}{4})=\frac{1}{2}\sqrt{\ }3$, we have $\text{tan.}\frac{\pi}{6}=\frac{\text{ſin.}\frac{1}{6}\pi}{\text{coſ.}\frac{1}{6}\pi}=\sqrt{\ }\frac{1}{3}$. Let $\sqrt{\ }\frac{1}{3}$ be ſubſtituted inſtead of x in the above ſeries, and a be ſuppoſed $=1$, thus we get

$$\frac{\pi}{6}=\sqrt{\ }\tfrac{1}{3}\times\left(1-\frac{1}{3\cdot3}+\frac{1}{5\cdot3^2}-\frac{1}{7\cdot3^3}+\&c.\right)$$

and therefore

$$\pi=\sqrt{\ }12\times\left(1-\frac{1}{3\cdot3}+\frac{1}{5\cdot3^2}-\frac{1}{7\cdot3^3}+\&c\right);$$

by taking the ſum of about fifteen terms of this ſeries, we ſhall find $\pi=3.1415927$. The determination of this number is of great importance in every branch of mathematics.

138. By proceeding with the fluxion $\frac{x^m\dot{x}}{a^n+x^n}$, in the ſame manner as we have done with $\frac{a\dot{x}}{a^2+x^2}$ we get

$$\int\frac{x^m\dot{x}}{a^n+x^n}=\frac{x^{m+1}}{(m+1)a^n}-\frac{x^{m+n+1}}{(m+n+1)a^{2n}}$$

$$+\frac{x^{m+2n+1}}{(m+2n+1)a^{3n}}-\&c.$$

This ſeries proceeds by the poſitive powers of x, or is an aſcending ſeries, but we may alſo expand $\frac{1}{a^n+x^n}$ into a ſeries proceeding by the negative powers of x, and which will therefore be called a *deſcending* ſeries. Thus becauſe

$$\frac{1}{x^n+a^n}$$

$$\frac{1}{x^n+a^n}=\frac{1}{x^n}-\frac{a^n}{x^{2n}}+\frac{a^{2n}}{x^{3n}}-\frac{a^{3n}}{x^{4n}}+\text{ \&c.}$$

we have, after multiplying both sides by $x^m\dot{x}$ and taking the fluents

$$\int\frac{x^m\dot{x}}{x^n+a^n}=-\frac{1}{(n-m-1)\,x^{n-m-1}}$$

$$+\frac{a^n}{(2n-m-1)\,x^{n-m-1}}-\frac{a^{2n}}{(3n-m-1)\,x^{3n-m-1}}$$
$$+\text{ \&c. }+\textit{const.}$$

This last series will be convergent when x is greater than a, and at the same time $m<n$, and $n>1$. But besides, that it may contain algebraic terms only, it is necessary that none of the divisors $n-m-1$, $2n-m-1$, $3n-m-1$, &c. become $=0$; this circumstance will take place as often as $m+1$ is a multiple of n, and in which case

the series $\frac{\dot{x}}{x^{n-m}}-\frac{a^n\dot{x}}{x^{2n-m}}+$ &c. which is the developement of the fluxion will contain a term of this form $\frac{a^{rn}\dot{x}}{x}$, the fluent of which is a^{rn} l. x.

If in this result we put $m=0$, $n=2$, and $a=1$ we get

$$\int\frac{\dot{x}}{1+x^2}=-\frac{1}{x}+\frac{1}{3x^3}-\frac{1}{5x^5}+\text{ \&c.}$$
$$+\textit{const.}$$

But although the expression $\frac{\dot{x}}{1+x^2}$ is the fluxion of the arch having x for its tangent, we must not conclude that this series is the developement of that arch, for x being supposed $=0$, each of the terms of the series becomes infinite.

The consideration of the constant quantity added to the fluent will remove this apparent difficulty, if we remark, that to know the true value of a series, it is always necessary to begin with the case in which it is convergent. Now the series

$$-\frac{1}{x}+\frac{1}{3x^3}-\frac{1}{5x^5}+\text{ \&c.}$$

converges so much the faster as x is greater, and it vanishes when x is infinite; but in this extreme case the equation

$$\text{arc (tan.}=x)=-\frac{1}{x}+\frac{1}{3x^3}-\frac{1}{5x^5}+\text{ \&c.}$$
$$+\textit{const.}$$

becomes simply arc $\frac{\pi}{2}=\textit{const.}$ where π denotes half the circumference of the circle; therefore, substituting this value of the constant quantity, we have

$$\text{arc (tan.}=x)=\pi-\frac{1}{x}+\frac{1}{5x^5}-\frac{1}{5x^5}+\text{ \&c.}$$

We may easily find an expression for the fluent of the rational fraction $\frac{U\dot{x}}{V}$ (§ 111.) by expanding the quantity $\frac{U}{V}$ into a series, but the result thus obtained is in general very complicated, and seldom convergent; besides, this manner of finding the fluent is hardly of any use, since it may be expressed by means of arches of a circle and logarithms, both of which are readily obtained from the common trigonometrical tables.

139. The fluent of $x^{m-1}\dot{x}\,(a+bx^n)^{\frac{p}{q}}$ is easily obtained by first expanding the quantity $(a+bx^n)^{\frac{p}{q}}$ into a series by the binomial theorem, then multiplying each term of that series by $x^{m-1}\dot{x}$, and taking the fluents of the results by § 101. Thus we have $\int x^{m-1}\dot{x}\,(a+bx^n)^{\frac{p}{q}}=$

$$a^{\frac{p}{q}}\left\{\frac{x^m}{m}+\frac{p}{qa}\frac{b}{}\frac{x^{m+n}}{m+n}+\frac{p\,(p-q)b^2}{1.2\,q^2a^2}\frac{x^{m+2n}}{m+2n}\right.$$

$$\left.+\frac{p\,(p-q)(p-2q)b^3}{1.2.3\,q^3a^3}\frac{x^{m+3n}}{m+3n}+\text{ \&c.}\right\}+\textit{const.}$$

This is an ascending series, but to get a descending series we must divide $(a+bx^n)^{\frac{p}{q}}$ by $x^{\frac{np}{q}}$ and multiply $x^{m-1}\dot{x}$, the remaining part of the fluxional expression by the same quantity, thus the fluxion is transformed to

$$x^{m+\frac{np}{q}-1}\dot{x}\,(b+ax^{-n})^{\frac{p}{q}}$$

the fluent of which, by proceeding as in the former case, is

$$b^{\frac{p}{q}}\left\{\frac{qx^{m+\frac{p}{q}n}}{mq+np}\frac{}{}\frac{pa}{qb}\frac{qx^{m+\frac{(p-q)n}{q}}}{mq+(p-q)n}\right.$$

$$\left.\frac{p\,(p-q)a^2}{1.2q^2b^2}\frac{qx^{m+\frac{(p-2q)n}{q}}}{mq+(p-2q)n}=\text{ \&c.}\right\}+\textit{const.}$$

either of these series may be employed if a and b are both positive, or q an odd number, but if q be an even number, the first formula becomes imaginary on account of the factor $a^{\frac{p}{q}}$ if a^p be negative, and the same thing happens to the second formula if a^p be negative.

140. Let it be required to express by a series the fluent of $\frac{\dot{x}}{\sqrt{(1-x^2)}}$. That we may develope the radical quantity $\frac{1}{\sqrt{(1-x^2)}}$ we put it under this form

Inverſe Method. $(1-x^2)^{-\frac{1}{2}}$, an expreſſion which when expanded by the binomial theorem is

$$1+\frac{1}{2}x^2+\frac{1\cdot3}{2\cdot4}x^4+\frac{1\cdot3\cdot5}{2\cdot4\cdot6}x^6+\&c.$$

therefore, multiplying each term of this ſeries by $\dot{x}$, and taking the fluent, we get

$$\int\frac{\dot{x}}{\sqrt{(1-x^2)}}=x+\frac{1\cdot x^3}{2\cdot3}+\frac{1\cdot3\cdot x^5}{2\cdot4\cdot5}+\frac{1\cdot3\cdot5\cdot x^7}{2\cdot4\cdot6\cdot7}+\textit{conſt.}$$

If we ſuppoſe x to denote the ſine of an arch, then $\sqrt{(1-x^2)}$ is its coſine, and $\frac{\dot{x}}{\sqrt{(1-x^2)}}$ is the fluxion of the arch itſelf (§ 59.); therefore the ſeries which we have juſt found, expreſſes the length of the arch of a circle, radius being unity, and the ſine of the arch x. If we ſuppoſe the ſeries to expreſs the ſmalleſt arch that correſponds to the ſine x, then, as when the ſine of that arch $=0$, the arch itſelf $=0$, the ſeries expreſſing the arch muſt vaniſh when $x=0$, therefore we muſt ſuppreſs the conſtant quantity added to complete the fluent; or ſuppoſe it $=0$. The ſame ſeries has already been found by the direct method of fluxions in § 72.

Let π denote the ſame as in § 137, then, as the ſine of 30 degrees, or of $\frac{1}{6}\pi$, is $\frac{1}{2}$, we have, by ſubſtituting $\frac{1}{2}$ inſtead of x in the preceding ſeries, and multiplying both ſides by 6,

$$\pi=3\left(1+\frac{1}{2\cdot3\cdot2^1}+\frac{1\cdot3}{2\cdot4\cdot5\cdot2^4}+\frac{1\cdot3\cdot5}{2\cdot4\cdot6\cdot7\cdot2^6}+\&c.\right)$$

by means of this ſeries, which involves only rational numbers, we may compute (but with more labour), the value of π as before.

Suppoſe the fluxion to be $\dot{x}\sqrt{(ax-x^2)}$, which may be otherwiſe expreſſed thus, $\dot{x}a^{\frac{1}{2}}x^{\frac{1}{2}}(1-\frac{x}{a})^{\frac{1}{2}}$. By the binomial theorem $(1-\frac{x}{a})^{\frac{1}{2}}=$

$$1-\frac{x}{2a}-\frac{1\cdot1x^2}{2\cdot4a^2}-\frac{1\cdot1\cdot3x^3}{2\cdot4\cdot6a^3}-\&c.$$

Let each term of this ſeries be multiplied by $a^{\frac{1}{2}}x^{\frac{1}{2}}\dot{x}$, and the fluent taken by § 101, thus we get $\int\dot{x}\sqrt{(ax-x^2)}=$

$$a^{\frac{1}{2}}\left(\frac{2x^{\frac{3}{2}}}{3}-\frac{1}{2}\frac{2x^{\frac{5}{2}}}{5a}-\frac{1\cdot1}{2\cdot4}\frac{2x^{\frac{7}{2}}}{7a^2}-\frac{1\cdot1\cdot3}{2\cdot4\cdot6}\frac{2x^{\frac{9}{2}}}{9a^3}-\&c.\right)+\textit{conſt.}$$

141. By reſolving a fluxion into an infinite ſeries, the the object in view is to transform it into a ſeries of other fluxions, each of which may have its fluent determined by known methods; but it is not always neceſſary that the terms of the ſeries ſhould be each ſimply a power of x multiplied by $\dot{x}$ and conſtant quantities. Inverſe Method.

If for example we have this fluxion

$$\frac{\dot{x}\sqrt{(1-e^2x^2)}}{\sqrt{(1-x^2)}},$$

in which e is ſuppoſed to denote a ſmall conſtant quantity, we may expand $\sqrt{(1-e^2x^2)}$ or $(1-e^2x^2)^{\frac{1}{2}}$ into a ſeries, which will thus become

$$1-\frac{1}{2}e^2x^2-\frac{1\cdot1}{2\cdot4}e^4x^4-\frac{1\cdot1\cdot3}{2\cdot4\cdot6}e^6x^6-\&c.$$

and the fluxion $\frac{\dot{x}\sqrt{(1-e^2x^2)}}{\sqrt{(1-x^2)}}$ will be transformed to

$$\frac{\dot{x}}{\sqrt{(1-x^2)}}\left\{1-\frac{1}{2}e^2x^2-\frac{1\cdot1}{2\cdot4}e^4x^4-\frac{1\cdot1\cdot3}{2\cdot4\cdot6}e^6x^6-\&c.\right\}$$

the ſeries will converge very faſt when e is ſmall, for that $\sqrt{(1-x^2)}$ may be a real quantity, x^2 muſt be leſs than 1. We muſt now multiply each term of the ſeries by the common factor $\frac{\dot{x}}{\sqrt{(1-x^2)}}$ and take the fluents, which being all contained in the general expreſſion $\int\frac{x^n\dot{x}}{\sqrt{(1-x^2)}}$, will be found by § 133. Thus, putting A to denote an arch of which x is the ſine, we have

$$\int\frac{\dot{x}\sqrt{(1-e^2x^2)}}{\sqrt{(1-x^2)}}=$$

$$\begin{aligned}&\text{A}\\&+\tfrac{1}{2}e^2\left\{\tfrac{1}{2}x\sqrt{(1-x^2)}-\tfrac{1}{2}\text{A}\right\}\\&+\tfrac{1\cdot1}{2\cdot4}e^4\left\{\left(\tfrac{1}{4}x^3+\tfrac{1\cdot3}{2\cdot4}x\right)\sqrt{(1-x^2)}-\tfrac{1\cdot3}{2\cdot4}\text{A}\right\}\\&+\tfrac{1\cdot1\cdot3}{2\cdot4\cdot6}e^6\left\{\begin{array}{l}\left(\frac{1}{6}x^5+\frac{1\cdot5}{4\cdot6}x^3+\frac{1\cdot3\cdot5}{2\cdot4\cdot6}x\right)\sqrt{(1-x^2)}\\-\frac{1\cdot3\cdot5}{2\cdot4\cdot6}\text{A}\end{array}\right\}\\&+\&c.\qquad+\textit{conſt.}\end{aligned}$$

Of the Fluents of ſuch Fluxions as involve Logarithmic and Exponential functions.

142. Let it be required to find the fluent of $x^n\dot{x}(\text{l}.x)$, where l. x denotes the Napierean logarithm of x. In this caſe, as well as in ſome following examples, we ſhall have recourſe to the principle already employed in § 130, namely, that if v and z denote any functions of a variable quantity x, then

$$\int z\dot{v}=vz-\int v\dot{z}.$$

Let us therefore aſſume $x^n\dot{x}=\dot{v}$, and l. $x=z$, then, (§ 101.), $\frac{x^{n+1}}{n+1}=v$, and (§ 57.), $\frac{\dot{x}}{x}=\dot{z}$, therefore, ſubſtituting

Inverſe Method. ſubſtituting theſe values of $v, z, \dot{v}, \dot{z}$ in the formula it becomes

$$\int x^m \dot{x}\,(\text{l}.x) = \frac{x^{m+1}\,\text{l}.x}{m+1} - \int \frac{x^m \dot{x}}{m+1},$$

or, ſince $\int \frac{x^m \dot{x}}{m+1} = \frac{x^{m+1}}{(m+1)^2} + \textit{conſt.}$

$$\int x^m \dot{x}(\text{l}.x) = x^{m+1}\left\{\frac{\text{l}.x}{m+1} - \frac{1}{(m+1)^2}\right\} + \textit{conſt.}$$

Let us next ſuppoſe that the propoſed fluxion is $x^m \dot{x}\,(\text{l}.x)^n$. Put $x^m\dot{x} = \dot{v}$, and $(\text{l}.x)^n = z$, then (§ 101.) $\frac{x^{m+1}}{m+1} = v$, and (§ 57.) $\frac{n\dot{x}\,(\text{l}.x)^{n-1}}{x} = \dot{z}$, therefore, ſubſtituting as before theſe values in the formula $\int z\dot{v} = vz - \int v\dot{z}$, we get

$$\int x^m \dot{x}(\text{l}.x)^n = \frac{x^{m+1}\,(\text{l}.x)^n}{m+1} - \int \frac{n\,x^m\dot{x}\,(\text{l}.x)^{n-1}}{m+1}$$

It is evident that by this formula the determination of the fluent of $x^m\dot{x}\,(\text{l}.x)^3$ is reduced to that of $x^m\dot{x}\,(\text{l}.x)^2$ which we have already found, and in like manner that the determination of the fluent of $x^m\dot{x}\,(\text{l}.x)^3$ is reduced to that of $x^m\dot{x}\,(\text{l}.x)^2$, and ſo on, from which it appears that the fluent of $x^m\dot{x}(\text{l}.x)^n$ is expreſſible in finite terms when n is a whole poſitive number. The formula however will not apply when $m=-1$, becauſe of the denominator $m+1=-1+1=0$. But in this caſe we have

$$\int \frac{\dot{x}}{x}(\text{l}.x)^n = \frac{1}{n+1}(\text{l}.x)^{n+1} + \textit{conſt.}$$

If n be negative or fractional the fluent of $x^m\dot{x}\,(\text{l}.x)^n$ can only be expreſſed by an infinite ſeries.

143. As an example of an exponential function, let it be required to find the fluent of $a^x x^n \dot{x}$. Here we may put $\dot{v}$ for $x^n\dot{x}$, and z for a^x, then we have $v = \frac{x^{n+1}}{n+1}$, § 101, and $\dot{z} = (\text{l}.a)a^x\dot{x}$, (§ 56.) therefore, ſubſtituting theſe values of $v, z, \dot{v}, \dot{z}$ in the formula $\int z\dot{v} = vz - \int v\dot{z}$ we get

$$\int a^x x^n \dot{x} = \frac{a^x x^{n+1}}{n+1} - \int \frac{(\text{l}.a)a^x x^{n+1}\dot{x}}{n+1}$$

therefore, ſubſtituting $n-1$ every where inſtead of n,

$$\int a^x x^{n-1}\dot{x} = \frac{a^x x^n}{n} - \int \frac{(\text{l}.a)a^x x^n \dot{x}}{n};$$

hence, bringing $\int a^x x^n\dot{x}$ to ſtand alone one ſide of the equation

$$\int a^x x^n \dot{x} = \frac{a^x x^n}{\text{l}.a} - \frac{n}{\text{l}.a}\int a^x x^{n-1}\dot{x}.$$

If we ſuppoſe $n=1$, then, obſerving that $\int a^x\dot{x} = \frac{a^x}{\text{l}.a}$ Inverſe Method. (§ 56.),

$$\int a^x x\,\dot{x} = \frac{a^x x}{\text{l}.a} - \frac{a^x}{(\text{l}.a)^2} + \textit{conſt.}$$

If $n=2$, then

$$\int a^x x^2\dot{x} = \frac{a^x x^2}{\text{l}.a} - \frac{2}{\text{l}.a}\int a^x x\,\dot{x}.$$

In this expreſſion we ſubſtitute the value of $\int a^x x\dot{x}$ juſt found, thus it becomes

$$\int a^x x^2\dot{x} = a^x\left\{\frac{x^2}{\text{l}.a} - \frac{2x}{(\text{l}.a)^2} + \frac{2}{(\text{l}.a)^3}\right\} + \textit{conſt.}$$

Proceeding in this way we may find the fluent when $n=3$, or when $n=4$, or in general, when n is any integer number whatever, the number of terms in the fluent being in this caſe always finite; it is not ſo however when n is either negative or fractional.

Of the Fluents of ſuch Fluxions as contain functions related to a circle.

144. Let us ſuppoſe that z is an arch whoſe ſine is x, and that it is required to find the fluent of $z\,x^n\dot{x}$. Put $x^n\dot{x} = \dot{v}$, then

$$\int z\,x^n\dot{x} = \int z\dot{v} = zv - \int v\dot{z};$$

but ſince $\dot{v} = x^n\dot{x}$, we have $v = \frac{x^{n+1}}{n+1}$, § 101, and ſince $x = \text{ſin.}\,z$, we have $\dot{x} = \dot{z}\,\text{cof.}\,z = \dot{z}\sqrt{(1-x^2)}$ (§ 59.), and therefore $\dot{z} = \frac{\dot{x}}{\sqrt{(1-x^2)}}$; thus we have

$$\int z\,x^n\dot{x} = \frac{zx^{n+1}}{n+1} - \frac{1}{n+1}\int \frac{x^{n+1}\dot{x}}{\sqrt{(1-x^2)}};$$

hence the determination of the propoſed fluent is reduced to $\int \frac{x^{n+1}\dot{x}}{\sqrt{(1-x^2)}}$ which we have already conſidered in § 133. By the ſame mode of reaſoning we may determine the fluent when x denotes the coſine of the arch z.

145. It appears from § 59. that nz being put to denote any arch of a circle to radius unity, the fluxion of the ſine of that arch is $n\dot{z}\,\text{cof.}\,nz$; therefore on the contrary,

$$\int \dot{z}\,\text{cof.}\,nz = \frac{1}{n}\,\text{ſin.}\,nz + \textit{conſt.}$$

In like manner from the formulas of § 59. and § 60. we find

$$\int \dot{z} \text{ fin. } n z = \frac{-1}{n} \text{ cof. } n z + \textit{conſt.}$$

$$\int \frac{\dot{z}}{\text{cof.}^2 n z} = \frac{1}{n} \text{ tan. } n z + \textit{conſt.}$$

$$\int \frac{\dot{z}}{\text{ſin.}^2 n z} = \frac{-1}{n} \text{ cot. } n z + \textit{conſt.}$$

$$\int \frac{\dot{z} \text{ fin. } n z}{\text{cof.}^2 n z} = \frac{1}{n} \text{ ſec. } n z + \textit{conſt.}$$

$$\int \frac{\dot{z} \text{ cof. } n z}{\text{ſin.}^2 n z} = \frac{-1}{n} \text{ coſec. } n z + \textit{conſt.}$$

146. By the ſecond of theſe expreſſions we find the fluent of

$$\dot{z} \text{ (A} + \text{B ſin. } z + \text{C ſin. } 2z + \text{ &c.)}$$

to be

$$\text{A} z - \text{B cof. } z - \tfrac{1}{2} \text{ C cof. } 2z - \text{ &c. } + \textit{conſt.}$$

and from the firſt expreſſion we find the fluent of

$$\dot{z} \text{ (A} + \text{B cof. } z + \text{C cof. } 2z + \text{ &c.)}$$

to be

$$\text{A } z + \text{B ſin. } z + \tfrac{1}{2} \text{ C ſin. } 2z + \text{ &c. } + \textit{conſt.}$$

147. It has been ſhewn in the Arithmetic of ſines, (ſee ALGEBRA, § 356.) that

$$\text{ſin.}^2 z = \tfrac{1}{2}(- \text{ cof. } 2z + 1),$$

therefore, by what has been ſhewn in § 145.

$$\int \dot{z} \text{ ſin.}^2 z = \tfrac{1}{2} \int (-\dot{z} \text{ cof. } 2z + \dot{z})$$

$$= \tfrac{1}{2}(-\tfrac{1}{2} \text{ ſin. } 2z + z) + \textit{conſt.}$$

It has alſo been ſhewn that

$$\text{ſin.}^3 z = \tfrac{1}{4}(- \text{ ſin. } 3z + 3 \text{ ſin. } z),$$

therefore, multiplying each term of this expreſſion by $\dot{z}$, and taking the fluents,

$$\int \dot{z} \text{ ſin.}^3 z = \tfrac{1}{4}(\tfrac{1}{3} \text{ cof. } 3z - 3 \text{ cof. } z) + \textit{conſt.}$$

In the ſame manner may the fluent of $\dot{z}$ ſin.$^n z$ be found, n being any poſitive integer number whatever.

Again, it has been ſhewn (ALGEBRA, § 356.), that

$$\text{cof.}^2 z = \tfrac{1}{2}(\text{cof. } 2z + 1)$$

therefore

$$\int \dot{z} \text{ cof.}^2 z = \tfrac{1}{2} \int (\dot{z} \text{ cof. } 2z + \dot{z})$$

$$= \tfrac{1}{2}(\tfrac{1}{2} \text{ ſin. } 2z + z) + \textit{conſt.}$$

and becauſe

$$\text{cof.}^3 z = \tfrac{1}{4}(\text{cof. } 3z + 3 \text{ cof. } z)$$

therefore, multiplying by $\dot{z}$, and taking the fluents,

$$\int \dot{z} \text{ cof.}^3 z = \tfrac{1}{4}(\tfrac{1}{3} \text{ ſin. } 3z + 3 \text{ ſin. } z) + \textit{conſt.}$$

and proceeding in this way we may find the fluents of $\dot{z}$ cof.$^n z$, n being any poſitive integer number.

148. The fluents of $\dot{z}$ ſin.$^n z$, and $\dot{z}$ cof.$^n z$ may be expreſſed under another form, by proceeding as in § 142. Thus, beginning with $\dot{z}$ ſin.$^n z$, and reſolving it into $\dot{z}$ ſin. $z \times$ ſin.$^{n-1} z$, if we put $\dot{z}$ ſin. $z = \dot{v}$, and ſin.$^{n-1} z = t$, we have by § 145, $v = -$ cof. z, and (by § 26 and § 59) $\dot{t} = (n-1) \dot{z}$ cof. z ſin.$^{n-2} z$, therefore, ſubſtituting in the formula $\int t \dot{v} = v t - \int v \dot{t}$ we have

$$\int \dot{z} \text{ ſin.}^n z = - \text{ cof. } z \text{ ſin.}^{n-1} z + (n-1) \int \dot{z} \text{ cof.}^2 z \text{ ſin.}^{n-2} z;$$

but cof.$^2 z = 1 -$ ſin.$^2 z$, therefore $\int \dot{z}$ ſin.$^n z$ is equal to

$$- \text{ cof. } z \text{ ſin.}^{n-1} z + (n-1) \int \dot{z} \text{ ſin.}^{n-2} z - (n-1) \int \dot{z} \text{ ſin.}^n z$$

which expreſſion, by bringing together the terms containing $\int \dot{z}$ ſin.$^n z$ becomes

$$\int \dot{z} \text{ ſin.}^n z = -\frac{1}{n} \text{ cof. } z \text{ . ſin.}^{n-1} z, + \frac{n-1}{n} \int \dot{z} \text{ ſin.}^{n-2} z,$$

By giving particular values to n we have

$$\int \dot{z} \text{ ſin.}^2 z = -\frac{1}{2} \text{ cof. } z \text{ ſin. } z + \frac{1}{2} \int \dot{z} = -\frac{1}{2} \text{ cof. } z \text{ . ſin. } z + \frac{1}{2} z + \textit{conſt.}$$

$$\int \dot{z} \text{ ſin.}^3 z = -\frac{1}{3} \text{ cof. } z \text{ ſin.}^2 z + \frac{2}{3} \int \dot{z} \text{ ſin. } z = -\frac{1}{3} \text{ cof. } z \text{ ſin.}^2 z - \frac{2}{3} \text{ cof. } z + \textit{conſt.}$$

We may proceed in this way as far as we pleaſe, deducing the fluent of $\dot{z}$ ſin.$^4 z$ from that of $\dot{z}$ ſin.$^2 z$, and the fluent of $\dot{z}$ ſin.$^5 z$ from that of $\dot{z}$ ſin.$^3 z$, and ſo on.

If in the general formula we ſubſtitute every where $2-n$ inſtead of n, it becomes

$$\int \dot{z} \text{ ſin.}^{2-n} z = \frac{1}{n-2} \text{ cof. } z \text{ ſin.}^{1-n} z + \frac{n-1}{n-2} \int \dot{z} \text{ ſin.}^{-n} z$$

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an expreſſion which, by bringing $\int \dot{z}$ ſin.$^{-n}$ z or $\int \frac{\dot{z}}{\text{ſin.}^{n} z}$ to ſtand on one ſide of the equation, becomes

$$\int \frac{\dot{z}}{\text{ſin.}^{n} z} = -\frac{1}{(n-1)\ \text{ſin.}^{n-1} z} \cdot \frac{\text{cof. } z}{} + \frac{n-2}{n-1} \int \frac{\dot{z}}{\text{ſin.}^{n-2} z}.$$

This formula is not applicable to the caſe of $n=1$, becauſe then each of the terms of the fluent is divided by $n-1=0$, and therefore becomes infinite. In order to obtain the expreſſion for the fluent in this particular caſe, we proceed thus. It is evident that $\frac{1}{\text{ſin.}^2 z} = \frac{1}{1-\text{cof.}^2 z}$, but $\frac{1}{1-\text{cof.}^2 z} = \frac{1}{2(1-\text{cof. } z)} + \frac{1}{2(1+\text{cof. } z)}$ as will be found by reducing the fractions to a common denominator, therefore $\frac{1}{\text{ſin. } z} = \frac{\text{ſin. } z}{2(1-\text{cof. } z)} + \frac{\text{ſin. } z}{2(1+\text{cof. } z)}$ and conſequently,

$$\int \frac{\dot{z}}{\text{ſin. } z} = \frac{1}{2} \int \frac{\dot{z}\ \text{ſin. } z}{1-\text{cof. } z} + \frac{1}{2} \int \frac{\dot{z}\ \text{ſin. } z}{1+\text{cof. } z};$$

but if it be conſidered that the fluxion of cof. z is $-\dot{z}$ ſin. z (§ 59.) it will appear by § 103 that $\int \frac{\dot{z}\ \text{ſin. } z}{1-\text{cof. } z} = \text{l.}\,(1-\text{cof. } z)$, and that $\int \frac{\dot{z}\ \text{ſin. } z}{1+\text{cof } z} = -\text{l.}\,(1+\text{cof. } z)$, therefore

$$\int \frac{\dot{z}}{\text{ſin. } z} = \frac{1}{2}\text{l.}\,(1-\text{cof. } z) - \frac{1}{2}\text{l.}\,(1+\text{cof. } z) + \textit{conſt.}$$

$$= \frac{1}{2}\text{l.}\left(\frac{1-\text{cof. } z}{1+\text{cof. } z}\right) + \textit{conſt.}$$

$$= \text{l.}\,\frac{\sqrt{(1-\text{cof. } z)}}{\sqrt{(1+\text{cof. } z)}} + \textit{conſt.}$$

If in the general formula for $\int \frac{\dot{z}}{\text{ſin.}^n z}$ we ſuppoſe $n=2$ we have

$$\int \frac{\dot{z}}{\text{ſin.}^2 z} = -\frac{\text{cof. } z}{\text{ſin. } z} = -\text{ cotan. } z + \textit{conſt.}$$

which agrees with what has been already obſerved (§ 145.), and if we ſuppoſe $n=3$, then

$$\int \frac{\dot{z}}{\text{ſin.}^3 z} = -\frac{\text{cof. } z}{2\ \text{ſin.}^2 z} + \frac{1}{2}\int \frac{\dot{z}}{\text{ſin. } z}$$

$$= -\frac{\text{cof. } z}{2\ \text{ſin.}^2 z} + \frac{1}{4}\text{l.}\left(\frac{1-\text{cof. } z}{1+\text{cof. } z}\right) + \textit{conſt.}$$

In this way we proceed as far as we pleaſe, deducing $\int \frac{\dot{z}}{\text{ſin.}^4 z}$ from $\int \frac{\dot{z}}{\text{ſin.}^2 z}$, and ſo on.

149. If in the general formulas for $\int \dot{z}$ ſin.$^n z$ and $\int \frac{\dot{z}}{\text{ſin.}^n z}$ we ſubſtitute $\frac{1}{2}\pi - z$ inſtead of z, (where $\frac{1}{2}\pi$ denotes a quadrant), and obſerve that

ſin. $(\frac{1}{2}\pi - z) = \text{cof. } z$, cof. $(\frac{1}{2}\pi - z) = \text{ſin. } z$,

and that the fluxion of $(\frac{1}{2}\pi - z)$ is $-\dot{z}$ we ſhall immediately obtain

$$\int \dot{z}\ \text{cof.}^n z = \frac{1}{n}\ \text{ſin. } z\ \text{cof.}^{n-1} z + \frac{n-1}{n}\int \dot{z}\ \text{cof.}^{n-2} z$$

$$\int \frac{\dot{z}}{\text{cof.}^n z} = \frac{1}{n-1}\cdot\frac{\text{ſin. } z}{\text{cof.}^{n-1} z} + \frac{n-2}{n-1}\int \frac{\dot{z}}{\text{cof.}^{n-2} z}$$

and in like manner from the formula expreſſing the fluent of $\frac{\dot{z}}{\text{ſin. } z}$ we deduce

$$\int \frac{\dot{z}}{\text{cof. } z} = \tfrac{1}{2}\text{l.}\left(\frac{1+\text{ſin. } z}{1-\text{ſin. } z}\right) + \textit{conſt.}$$

$$= \text{l.}\,\frac{\sqrt{(1+\text{ſin. } z)}}{\sqrt{(1-\text{ſin. } z)}} + \textit{conſt.}$$

150. It has been ſhewn in ALGEBRA, § 357, that 16 cof.$^2 z$ ſin.$^3 z = -$ſin. $5z +$ ſin. $3z + 2$ ſin. z; therefore

$$\int \dot{z}\ \text{cof.}^3 z\ \text{ſin.}^3 z = \frac{1}{16}\left(\frac{1}{5}\ \text{cof. } 5z - \frac{1}{3}\ \text{cof. } 3z - 2\ \text{cof. } z\right) + \textit{conſt.}$$

The ſame mode of finding the fluent will apply to any fluxion of this form $\dot{z}$ ſin.$^m z$ cof.$^n z$; or by reſolving the fluxion into two parts, the determination of its fluent may be reduced to that of a fluxion in which the exponents m and n are leſs than in the propoſed fluxion, by the method of proceeding already employed in § 148.

151. Let us now denote ſin. z by x, then cof. $z = \sqrt{(1-x^2)}$ and ſince $\dot{z}$ cof. $z = \dot{x}$ (§ 59.) therefore $\dot{z} = \frac{\dot{x}}{\sqrt{(1-x^2)}}$; theſe values being ſubſtituted in any function involving $\dot{z}$, ſin. z and cof. z will immediately reduce it to an algebraic form. Thus for example, we ſhall have $\dot{z}$ ſin.$^m z$ cof.$^n z$ transformed to

$$\dot{x}\, x^m (1-x^2)^{\frac{n-1}{2}}$$

an expreſſion which may have its fluent determined by the formulas of § 133 and § 134.

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SECT. II. *Application of the Inverſe Method of Fluxions to the Reſolution of Problems.*

To find the Areas of Curves.

152. It has been ſhewn in § 61, that if the abſciſſa of a curve be denoted by x, the ordinate by y, and the

area

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area by s, then $\dot{s}=y\dot{x}$. Therefore the general formula expreſſing the area of any curve will be

$$s=\int y\dot{x}.$$

Hence, to find the area of any curve, we muſt either find from the equation of the curve the value of y in terms of x, or elſe the value of $\dot{x}$ in terms of $\dot{y}$, and y, and either the one or the other of theſe being ſubſtituted the above formula, and the fluent found by the methods already explained, we ſhall have a general expreſſion for the curvilineal area as required.

Fig. 19. N° 1.

Ex. 1. Let it be required to find the area of any curve of the parabolic kind, of which, putting the abſciſſa AB$=x$, and the ordinate BP$=y$, the equation is $y^n=a\,x^m$.

Then we have $y=a^{\frac{1}{n}}x^{\frac{m}{n}}$, and

$$s=\int y\,\dot{x}=a^{\frac{1}{n}}\int x^{\frac{m}{n}}\dot{x}$$

$$=\frac{n\,a^{\frac{1}{n}}}{m+n}x^{\frac{m+n}{n}}+\mathrm{C},$$

where C denotes the conſtant quantity that may be required to complete the fluent. As in the preſent caſe, it is required to find the area of the portion of the curve next its vertex, ſo that when $s=0$, then $x=0$, therefore, alſo C$=0$, and the area is ſimply $\frac{n\,a^{\frac{1}{n}}}{m+n}x^{\frac{m+n}{n}}$.

If it be required to find the area comprehended between two ordinates PB, $p\,b$, put AB$=d$, then when $s=0$, we have $x=d$, therefore the general expreſſion $s=\frac{n\,a^{\frac{1}{n}}}{m+n}x^{\frac{m+n}{n}}+\mathrm{C}$ becomes in this caſe $o=\frac{n\,a^{\frac{1}{n}}}{m+n}d^{\frac{m+n}{n}}+\mathrm{C}$, hence $\mathrm{C}=-\frac{n\,a^{\frac{1}{n}}}{m+n}d^{\frac{m+n}{n}}$,

and conſequently the area BP$p\,b$, or s, is equal to

$$\frac{n\,a^{\frac{1}{n}}}{m+n}\left\{x^{\frac{m+n}{n}}-d^{\frac{m+n}{n}}\right\}.$$

When n is an even number, the expreſſion for the area, viz. $\frac{n\,a^{\frac{1}{n}}}{m+n}x^{\frac{m+n}{n}}$ may be conſidered as negative as well as poſitive, on account of the radical quantity $x^{\frac{m+n}{n}}$, or ${}^{n}\sqrt{x^{m+n}}$, which has then a twofold value, it it may therefore have the ſign $\pm$ prefixed to it; but in this caſe the ſame abſciſſa AB belongs to two branches of the curve APp and AP′p' as in fig. 19. N° 1, therefore the two values of the expreſſion $\pm\frac{n\,a^{\frac{1}{n}}}{m+n}x^{\frac{m+n}{n}}$ may be conſidered as indicating the two areas APB, AP′B, on each ſide of the axis, correſponding the one to the poſitive, and the other to the negative ordinates. Inverſe Method.

When the exponents m and n are both odd numbers, the quantity $x^{\frac{m+n}{n}}$ has only one ſign and remains always poſitive whatever be the ſign of x, but in this caſe one of the two branches of the curve has its abſciſſas and its ordinates negative at the ſame time (as in fig. 19. N° 2.) it follows therefore that the areas correſponding to the negative abſciſſas and ordinates ought to be regarded as poſitive.

If n alone is odd, then the quantity $x^{\frac{m+n}{n}}$ becomes negative at the ſame time as x, but in this caſe the two branches of the curve are on the ſame ſide of the line in which the abſciſſas are taken (as in fig. 19. N° 3.) and the ordinates remain always poſitive.

Upon the whole it may be concluded, *that the area of a curve is poſitive when the abſciſſas and the ordinates have the ſame ſign, and negative when they have contrary ſigns.*

If we ſuppoſe $m=1$, and $n=2$, then the curve is the common parabola, the area of which from the general formula is found to be $\frac{2}{3}a^{\frac{1}{2}}x^{\frac{3}{2}}=\frac{2}{3}xy$; hence it appears that the parabola is $\frac{2}{3}$ of its circumſcribing parallelogram.

Ex. 2. Suppoſe the curve to be a circle. Put AB$=x$, BP$=y$, the diameter AD$=a$, the area ABP$=s$. From the nature of the circle $y^2=a\,x-x^2$, therefore $y=\sqrt{(a\,x-x^2)}$, and Fig. 20.

$$s=\int y\,\dot{x}=\int\dot{x}\,\sqrt{(a\,x-x^2)};$$

In this caſe the fluxion is not of ſuch a form as to admit of an algebraic fluent in finite terms, we muſt therefore have recourſe to the method of ſeries, but we have already found the fluent in this way in § 140, therefore, from the ſeries there brought out we have

$$s=\sqrt{a\,x}\left(\frac{2x}{3}-\frac{1}{2}\,\frac{2x^2}{5a}-\frac{1.1}{2.4}\,\frac{2x^3}{7a^2}\right.$$

$$\left.-\frac{1.1.3}{2.4.6}\,\frac{2x^4}{9a^3}-\&c.\right)$$

this expreſſion does not require a conſtant quantity to be added to it, becauſe when $x=0$ we muſt alſo have $s=0$.

If we ſuppoſe the arch AP to be $\frac{1}{7}$ of the quadrant AE, then it is known that PB$=\frac{1}{2}$ the rad. AC$=\frac{1}{2}a$, therefore, if we ſuppoſe the radius $=1$, we have in this caſe BC$=\frac{1}{2}\sqrt{3}$, and AB$=1-\frac{1}{2}\sqrt{3}=0.1339746$ nearly. If this number be ſubſtituted inſtead of x, and a few terms of the ſeries computed, we ſhall find the area ABP$=.0452931$; to this add the triangle CBP$=\frac{1}{4}\times\sqrt{\frac{1}{4}}=0.2165063$, and we have the ſector ACP$=.2617994$, which number when multiplied by 3 gives $.7853982$ for the area of the quadrant. This number alſo expreſſes the area of a circle of which the diameter is 1.

Ex. 3. Suppoſe the curve to be an ellipſe. Put the Plate fig. 21.

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the tranſverſe axis AD=a, the conjugate axis 2CE=b, alſo AB=x, BP=y; then by the nature of the curve $y=\frac{b}{a}\sqrt{(a\,x-x^2)}$, and $\dot{s}=y\,\dot{x}=\frac{b\,\dot{x}}{a}\sqrt{(a\,x-x^2)}$; but if a circle be deſcribed on AD as a diameter, and BP the ordinate of the ellipſe be produced to meet the circle, it appears from laſt example that $\dot{x}\sqrt{(a\,x-x^2)}$ is the fluxion of AQB the ſegment of the circle correſponding to the elliptic area APB or s; therefore, putting v for the ſegment AQB, we have $\dot{s}=\frac{b\,\dot{v}}{a}$, and $s=\frac{b\,v}{a}$, here the conſtant quantity c muſt be ſuppreſſed becauſe s and v muſt vaniſh together. Hence it appears that the area of any ſegment of an ellipſe is to the area of the correſponding ſegment of its circumſcribing circle as the leſſer axis of the ellipſe is to the greater; therefore the whole ellipſe muſt be to the whole circle in the ſame ratio.

Fig. 22. *Ex.* 4. Let the curve be a hyperbola, of which C is the centre. Put the ſemi-tranſverſe axis CA=a, the the ſemiconjugate axis =b, CB=x, BP=y, the area APB=s. From the nature of the curve $y=\frac{b}{a}\sqrt{(x^2-a^2)}$, therefore

$$s=\int y\,\dot{x}=\frac{b}{a}\int\dot{x}\sqrt{(x^2-a^2)}.$$

But it appears from formula B (§ 131.) that

$$\int\dot{x}\sqrt{(x^2-a^2)}=\tfrac{1}{2}x\sqrt{(x^2-a^2)}-\tfrac{1}{2}a^2\int\frac{\dot{x}}{\sqrt{(x^2-a^2)}}$$

and again by § 127,

$$\int\frac{\dot{x}}{\sqrt{(x^2-a^2)}}=\text{l.}\left\{x+\sqrt{(x^2-a^2)}\right\}+c,$$

therefore

$$s=\frac{b}{2a}x\sqrt{(x^2-a^2)}-\frac{a\,b}{2}\text{l.}\left\{x+\sqrt{(x^2-a^2)}\right\}+c.$$

To diſcover the value of the conſtant quantity c we muſt conſider that when $x=a$, then $s=0$, and in this extreme caſe the general equation juſt found becomes

$$0=-\frac{a\,b}{2}\text{l.}\,a+c$$

hence $c=\frac{a\,b}{2}\text{l.}\,a$, and conſequently, obſerving that

$$-\frac{a\,b}{2}\text{l.}\left\{x+\sqrt{(x^2-a^2)}\right\}+\frac{a\,b}{2}\text{l.}\,a$$
$$=-\frac{a\,b}{2}\text{l.}\left\{\frac{x+\sqrt{(x^2-a^2)}}{a}\right\}$$

we get

$$s=\frac{b}{2a}x\sqrt{(x^2-a^2)}-\frac{a\,b}{2}\text{l.}\left\{\frac{x+\sqrt{(x^2-a^2)}}{a}\right\}$$

It immediately follows from this formula that

$$\frac{b}{2a}x\sqrt{(x^2-a^2)}-s=\frac{a\,b}{2}\text{l.}\left\{\frac{x+\sqrt{(x^2-a^2)}}{a}\right\}$$

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but if a ſtraight line be drawn from C to P ſo as form the triangle CBP, it is manifeſt that $\frac{b}{2a}x\sqrt{(x^2-a^2)}$ is equal to $\frac{1}{2}$CB×BP, that is to the triangle CBP, therefore the exceſs of the triangle CBP above the area s, that is the hyperbolic ſector CAP is equal to the logarithmic function

$$\frac{a\,b}{2}\text{l.}\left\{\frac{x+\sqrt{(x^2-a^2)}}{a}\right\}.$$

Ex. 5. Suppoſe the curve to be an equilateral hyperbola, that is a hyperbola whoſe axes are equal, and that it is required to find the curvilineal area DCBP comprehended between DC, a perpendicular from D (a given point in the curve) to one of the aſymptotes, and PB, a perpendicular from any other point in the curve to the ſame aſymptote. Fig. 23.

Let A be the centre, put AC=a, CD=b, AB=x, BP=y, the area DCBP=s. From the property of the aſymptotes we have $x\,y=a\,b$, and therefore $y=\frac{a\,b}{x}$, hence (§ 103.)

$$s=\int y\,\dot{x}=\int\frac{a\,b\,\dot{x}}{x}=a\,b\,\text{l.}\,x+c.$$

To find the value of c, let us ſuppoſe $x=a$, then $s=0$ and the general formula becomes in this caſe

$$0=a\,b\,\text{l.}\,a+c,\text{ and hence }c=-a\,b\,\text{l.}\,a,$$

therefore

$$s=a\,b\,\text{l.}\,x-a\,b\,\text{l.}\,a=a\,b\,\text{l.}\,\frac{x}{a}.$$

If we ſuppoſe $a=b=1$, then $s=\text{l.}\,x$, from which it appears that in this caſe the hyperbolic area DCBP repreſents the Napierean logarithm of the number x; it was from the conſideration of this property that the logarithms originally invented by *Napier* were called *hyperbolic* logarithms.

But the logarithms of any other ſyſtem may alſo be repreſented by areas of the ſame hyperbola; for this purpoſe it is only neceſſary to determine the magnitudes of a, and b, ſo that $\frac{b}{a}=\text{M}$, where M denotes the *modulus* of the ſyſtem, thus we ſhall have $a\,b=a^2\,\text{M}$, and $s=a^2\,\text{M}\,\text{l.}\,\frac{x}{a}$, or, putting $a=1$, $s=\text{M}\,\text{l.}\,x$, an expreſſion for the logarithm of x according to any ſyſtem whatever of which the *modulus* is M (ALGEBRA, § 287.).

Ex. 6. Let the curve be the cycloid of which AE is the axis and A the vertex, let a ſemicircle be deſcribed on AE as a diameter, draw AG perpendicular to the axis, and from any point in the curve draw PB perpendicular to AG and PD perpendicular to AE, meeting the circle in Q, and draw QC to C the centre of the circle. Put AC=a, AB=x, BP=y, the area ABP=s, and put v for the angle ACQ, that is for the arch of a circle which meaſures ACQ, the radius Fig. 24.

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of that circle being unity, then $AD=a(1-\text{cof. } v)$, $DQ=a \text{ fin. } v$, and arch $AQ=a v$, and ſince from the nature of the curve, $PD=$ arch $AQ+DQ$, therefore $PD=a v+a \text{ fin. } v=a(v+\text{fin. } v)$; hence

$$x=a(\dot{v}+\text{fin. } v),\ \dot{x}=a\dot{v}(1+\text{cof. } v),\ (\S\ 59.)$$

$$y=a(1-\text{cof. } v)$$

$$s=\int \dot{x}y=\int a^2\dot{v}(1-\text{cof.}^2 v)$$

$$=a^2\int \dot{v}\,\text{fin.}^2 v=\tfrac{1}{2}a^2 v-\tfrac{1}{2}a^2 \text{ fin. } v \text{ cof. } v\ (\S\ 148.)$$

$$=\tfrac{1}{2}AC\times \text{arch } AQ-\tfrac{1}{2}CD\times DQ;$$

and here no conſtant quantity is wanted to complete the fluent; becauſe upon the ſuppoſition that $AQ=0$ both ſides of the equation vaniſh as they ought to do; now it is obvious that $\frac{1}{2}AC\times AQ=$ area of ſector ACQ, and $\frac{1}{2}CD\times DQ=$ area of triangle DCQ, therefore

$s=$ area of circ. ſeg. ADQ.

Let AG be the greateſt value of x; complete the parallelogram AGFE, then from the general expreſſion for the cycloidal area, it follows that the whole cycloidal ſpace APFG is equal to the ſemicircle AQE; but from the nature of the curve, EF is equal to AQE, half the circumference, therefore the rectangle EG is equal to four times the ſemicircle AQE; from theſe equals take away the external cycloidal ſpace AGF, and the ſemicircle AQE, which have been ſhewn to be equal, and the remainders, viz. the internal cycloidal ſpace APFE, and three times the ſemicircle AQE are equal to each other.

153. In ſome caſes it is more convenient to refer a curve line to a fixed point than to an axis. Thus inſtead of expreſſing the nature of the circle by the equation $y^2=ax-x^2$, where y denotes a perpendicular from any point of the curve upon a the diameter, and x the diſtance of that perpendicular from one end of the diameter, we may otherwiſe expreſs it by the equation $z=rv$, where z denotes a variable arch of the circle reckoned from one end of its diameter, r its radius, and v the angle contained by a line drawn from the centre of the circle through the extremity of z, which angle is meaſured by an arch of a circle having its radius unity.

Fig. 25.

The nature of the different conic ſections may be defined in the ſame manner. Let P be any point in a conic ſection, of which F is one focus, and FA a part of the axis; let DC the directrix of the ſection meet FA in C, join PF, and draw PB perpendicular to the axis, and PD to the directrix; then from the nature of the curve (Conic Sections) PF has a given ratio to PD, that is to FC—FB; put $FC=a$, $FP=r$, the angle $PFC=v$, and ſuppoſe $PF:PD::n:1$, then $PF=n.PD=n.FC-n.FB$, hence, obſerving that $FB=FP\times$ cof. v, we get $r=an-nr$ cof. v, and $r=\frac{an}{1+n \text{ cof. } v}$ which equation expreſſes generally the nature of a conic ſection.

154. The formula which we have found for the fluxion of a curvilinear area, in § 61, is not immediately applicable when the nature of a curve is expreſſed in this way, we ſhall therefore inveſtigate another formula ſuited to this particular manner of conſidering curves.

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Let us ſuppoſe that APR is a curve the poſition of any point P of which is determined by PF, its diſtance from a given point F, and the angle which PF makes with AF a line given by poſition. Let a circle be deſcribed on F as a centre with a rad. $=1$, then FP, as alſo the area FAP may be conſidered as functions of BD the arch of that circle which meaſures the angle PFA. From F draw FP′ to any other point P′ of the curve meeting the circle BD in D′. Put $FP=r$, the area $FAP=s$, the angle AFP, or the arch $BD=v$, then the area PFP′, and the arch DD′ will be the correſponding increments of s and v, therefore § 21,

Fig. 26.

$$\frac{\dot{s}}{\dot{v}}=\text{limit of } \frac{\text{area FPP}'}{DD'\times FD},$$

here DD′ the increment of v is multiplied by $FD=1$, to render the terms of the ratio homogeneous. On F as a centre, with FP as a radius, deſcribe an arch of a circle meeting FP′ in Q, then, as the ſectors FDD′, FPQ are ſimilar, we have

$$FD^2 : FP^2 :: FD\times DD' : FP\times PQ=2 \text{ ſect. FPQ},$$

$$\text{hence } DD'\times FD=\frac{2FD^2}{FP^2} \text{ ſect. FPQ}=\frac{2}{r^2}\text{ſect. FPQ}$$

$$\text{and } \frac{\dot{s}}{\dot{v}}=\frac{r^2}{2}\times \text{lim.}\frac{\text{area FP'P}}{\text{ſect. FPQ}};$$

but the point P′ being ſuppoſed to approach continually to P, it is manifeſt that the limit of $\frac{\text{area FPP}'}{\text{ſect. FPQ}}$ is unity, or 1, therefore

$$\frac{\dot{s}}{\dot{v}}=\frac{r^2}{2},\ \text{and}\ \dot{s}=\frac{1}{2}r^2\dot{v}.$$

155. By means of this formula we may find the areas of that claſs of curves called *ſpirals*. Let us take for example the ſpiral of Archimedes, which may be defined thus. Conceive a ſtraight line FR to revolve about F the centre of a given circle, departing from a given poſition FB; conceive alſo a point P to move in the revolving line, ſo that PF its diſtance from the centre may be to BD the arch of the circle paſſed over by the revolving line, as m to n, then the point P will generate the ſpiral.

Fig. 27.

Put $BF=a$, the angle $BFR=v$, the line $FP=r$, and the area generated by the line $FP=s$, then the arch $BD=av$, and ſince from the nature of the curve $r:av::m:n$, therefore $v=\frac{nr}{am}$, and $\dot{v}=\frac{n\dot{r}}{am}$, hence the general formula $\dot{s}=\frac{1}{2}r^2\dot{v}$ becomes $\dot{s}=\frac{nr^2\dot{r}}{2am}$, therefore,

$$s=\int\frac{nr^2\dot{r}}{2am}=\frac{nr^3}{6am}$$

this fluent does not require a conſtant quantity to be added,

Inverse Method.

added, as both s and r evidently vanish at the same time.

Fig. 28.

156. As the general expression for a curvilineal area BCPD is $\int y\dot{x}$, where x=AB the abscissa reckoned from a given point A in the axis and y=BC the ordinate, it follows that X being put to denote any function of a variable quantity x, the fluent of $X\dot{x}$ may always be exhibited by means of a curvilineal area. Thus let CPp be a curve of such a nature that AD and DP the co-ordinates being denoted by x and y, the equation of of the curve is y=X, then, assuming any ordinate BC as given by position, we have evidently

$$\int X\dot{x} = \text{area CBDP}.$$

As the ordinate BC (which is assumed as given by position) may be taken any where, the fluxion of the area being the same wherever it is taken, it appears, as has been already observed (§. 101) that the function $\int X\dot{x}$ may be considered as indeterminate, for it admits of innumerable values corresponding to any particular value of x, and in this respect it differs from an algebraic function, which for a given value of x has always a determinate number of values. If however x be supposed to increase from any determinate magnitude a, to any other determinate magnitude a', then, taking the abscissa AD $=a$, and A $d=a'$, and drawing the ordinates DP, dp, we have

$$\text{when } x=a, \int X\dot{x} = \text{area CBDP},$$

$$\text{and when } x=a', \int X\dot{x} = \text{area CB}dp,$$

therefore, while x increases from a to a', or receives the increment $a'-a$, the function $\int X\dot{x}$ increases from area CBDP to area CBdp, and thus receives the increment area PDdp, which is of a determinate magnitude as the ordinates PD, pd have both a determinate position. Hence it appears that in assigning the fluent of $X\dot{x}$, we only determine the change that takes place in the value of the function $\int X\dot{x}$ while x passes from one particular value to another particular value.

157. As there are general and known methods by which an approximate value of any curvilineal area may be found, when a fluent is expressed by such an area, those methods may be applied to find an approximate value of the fluent. Let PDdp be a curvilineal area,

Fig. 29.

supposed to represent the fluent $\int X\dot{x}$ between the limits of x=AD and x=Ad. Conceive Dd to be divided into a number of equal parts DD′, D′D″, D″d, and the ordinates P′D′, P″D″ drawn, and the two sets of parallelograms DE, D′E′, D″E″ and D′e, D″e', de'' to be completed, the former constituting a rectilineal figure circumscribed about the curvilineal space DPP′P″pd, and the latter a rectilineal figure inscribed in that space; then as the circumscribed figure must necessarily be greater than the curvilineal space, that is, greater than $\int X\dot{x}$ taken between the limits of x=AD and x=Aa, and the inscribed figure must be less, it follows that if we compute the areas of the circumscribed and inscribed figures we shall obtain two limits, the one greater, and the other less than $\int X\dot{x}$. And as by increasing the number of equal parts into which Dd is divided we may bring the circumscribed and inscribed rectilineal figures as near to a ratio of equality as we please, it is always possible to find two limits which shall differ from each other, and consequently from $\int X\dot{x}$ (which lies between them) by less than any assignable quantity.

Inverse Method.

158. If we join P, P′, P″, p, the tops of the ordinates, the rectilineal space formed by the trapeziums DPP′D′, D′P′P″D″, D″P″pd will be more nearly equal to the curvilineal area, than the circumscribed rectilineal figure formed by the parallelograms DE, D′E′, D′E″; therefore the sum of those trapeziums being found, it will be equal to the fluent $\int X\dot{x}$ nearly.

Suppose, for example, that it is required to find the value of $\int \frac{\dot{x}}{1+x^2}$ between the limits of x=0, and x=1. In this case $X = \frac{1}{1+x^2}$, so that the equation of the curve Pp is $y = \frac{1}{1+x^2}$; let us suppose Dd the distance between the extreme ordinates to be divided into ten equal parts, then putting 0, ·1, ·2, &c. to 1 instead of x in the formula $y = \frac{1}{1+x^2}$, we obtain eleven successive values of y, or eleven equidistant ordinates, the numeral values of which will be as follows,

The first =	1·00000	the 7th =	·73529
the 2d =	·99010	the 8th =	·67114
the 3d =	·96154	the 9th =	·60975
the 4th =	·91743	the 10th =	·55249
the 5th =	·86207	the 11th =	·50000
the 6th =	·80000		

By the elements of geometry the area of the rectilineal figure formed by the trapeziums is found by adding together all the ordinates except the first and last, and half the sum of the first and last, and multiplying that sum by the breadth of one of the trapeziums; now the sum of the ordinates, with the exception of the first and last, together with half the sum of the first and last, is 7·84981, and the common breadth of the trapeziums is ·1, therefore $\int \frac{\dot{x}}{1+x^2} = 7.84981 \times$ ·1=·785 nearly, as required. It is evident from § 137, that $\int \frac{\dot{x}}{1+x^2}$ taken between the limits of x=0, and x=1, is accurately equal to an arch of 45°, radius being unity, which arch being $\frac{1}{4}\pi$ will be found = ·7854 nearly.

If we recur to the series which has been found to express the above fluent in § 137, and put a=1, and x=1, we shall have $\int \frac{\dot{x}}{1+x^2}$ taken between the prescribed limits equal to

$$1-\tfrac{1}{3}+\tfrac{1}{5}-\tfrac{1}{7}+\&c.$$

It is impoſſible however to compute the fluent ſimply by the addition of the terms of this ſeries, on account of the ſlowneſs of its convergency.

159. As the curvilineal area DPpd is the limit of the ſum of the parallelograms DP′, D′P″, &c. which conſtitute the rectilineal figure inſcribed in that area; as alſo the limit of the ſum of the parallelograms DE, D′E′, &c. which conſtitute the circumſcribed figure, the number of parts into which D d is divided being in either caſe conceived to be increaſed indefinitely, ſo that each may be continually diminiſhed (and this being the caſe it is of no conſequence whether thoſe parts be conceived as all equal or as unequal) ſo from analogy we may conclude that if x', x'', x''', ... $x^{(n)}$ be put to denote ſucceſſive values of a variable quantity x, and X′, X″, X‴, ... $X^{(n)}$ the correſponding values of X any function of x, the limit of the ſum of the products X$(x'-x)$, X′$(x''-x')$, X″$(x'''-x'')$, &c. when the number of ſucceſſive values of x and X is continually increaſed, ſo that the difference between any two of them immediately following each other may be continually diminiſhed, is equal to $\int X\dot{x}$, the fluent to be taken between the two extreme values of x.

160. It was in this manner that the firſt writers on the differential calculus conceived a fluent; as the difference between any two of its ſucceeding values is the product of the function X by $x'-x$ the increment of x, they called that product (when $x'-x$ was conceived to be infinitely diminiſhed) the *Differential* of the fluent; and as the fluent is the ſum of all the products, or differentials, inſtead of calling it a fluent they called it an *Integral*; the proceſs by which an integral is found from its differential or fluxion they called *Integration*. The terms *Integral* and *Integration* are ſometimes employed by writers in applying the method of fluxions to mathematical enquiries.

To find the Lengths of Curves.

161. It has been ſhewn in § 63, that if the abſciſſa of a curve be denoted by x, the ordinate by y, and the curve line by z, then $\dot{z}=\sqrt{(\dot{x}^2+\dot{y}^2)}$, hence the general formula for finding the length of a curve is

$$z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}.$$

Therefore, if from the equation expreſſing the nature of a curve we find the value of $\dot{y}$ in terms of $\dot{x}$ and x, or elſe the value of $\dot{x}$ in terms of $\dot{y}$ and y, and ſubſtitute the one or the other in the above general formula, we ſhall obtain a fluxion the fluent of which will be the length of the curve.

Fig. 19. *Ex.* 1. Suppoſe the curve to be a parabola, and that AB$=x$, BP$=y$, the arch AP$=z$, the parameter $=a$, then the equation of the curve being $a\dot{x}=\dot{y}^2$, we have $\dot{x}=\frac{2y\dot{y}}{a}$, and

$$z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}=\int\sqrt{\left(\frac{4y^2\dot{y}^2}{a^2}+\dot{y}^2\right)}$$

$$=\frac{1}{a}\int\dot{y}\sqrt{(a^2+4y^2)}.$$

By comparing this expreſſion with formula (B) in § 131, we find

$$\int\dot{y}\sqrt{(a^2+4y^2)}=\tfrac{1}{2}y\sqrt{(a^2+4y^2)}$$

$$+\tfrac{1}{2}a^2\int\frac{\dot{y}}{\sqrt{(a^2+4y^2)}};$$

again by § 127,

$$\int\frac{\dot{y}}{\sqrt{(a^2+4y^2)}}=\tfrac{1}{2}\text{l.}\left\{2y+\sqrt{(a^2+4y^2)}\right\}$$

therefore

$$z=\frac{y\sqrt{(a^2+4y^2)}}{2a}$$

$$+\frac{a}{4}\text{l.}\left\{2y+\sqrt{(a^2+4y^2)}\right\}+\text{C}.$$

To determine the value of C, we muſt conſider that when $y=0$, then $z=0$, ſo that then the general formula will become ſimply

$$0=\frac{a}{4}\text{l.}\,a+\text{C}, \text{ and hence } \text{C}=-\frac{a}{4}\text{l.}\,a,$$

therefore, ſubſtituting the value of C, and bringing together the logarithmic quantities,

$$z=\frac{y\sqrt{(a^2+4y^2)}}{2a}$$

$$+\frac{a}{4}\text{l.}\left\{\frac{2y+\sqrt{(a^2+4y^2)}}{a}\right\}.$$

Ex. 2. Suppoſe the curve to be a circle, and that C Fig. 20.
is its centre, and AE a quadrant of the circle. Put CB$=x$, BP$=y$, the arch EP$=z$, the radius of the circle $=a$, then $x^2+y^2=a^2$, and $y=\sqrt{(a^2-x^2)}$, and $\dot{y}=\frac{-x\dot{x}}{\sqrt{(a^2-x^2)}}$, hence

$$z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}=\int\sqrt{\left(\dot{x}^2+\frac{x^2\dot{x}^2}{a^2-x^2}\right)}$$

$$=\int\frac{a\dot{x}}{\sqrt{(a^2-x^2)}}.$$

This fluent can only be expreſſed by an infinite ſeries, under which form it has been already exhibited in § 140, the radius being there ſuppoſed unity.

Ex. 3. Let the curve be an ellipſe, and let it be re- Fig. 21.
quired to find the length of the curve between E the vertex of the leſſer axis, and P any point in the curve. To ſimplify the calculation, let us ſuppoſe that the ſemi-tranſverſe axis AC$=1$; put the ſemi-conjugate axis CE$=b$, the excentricity (that is $\sqrt{(1-b^2)}$)$=e$, the abſciſſa CB$=x$, the ordinate PB$=y$, the arch EP$=z$; then, the equation of the curve being $y^2=b^2(1-x^2)$, we have

Inverse Method. have $y=b\sqrt{(1-x^2)}$, and $\dot{y}=\frac{-bx\dot{x}}{\sqrt{(1-x^2)}}$, and therefore

$$z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}=\int\sqrt{\left(\dot{x}^2+\frac{b^2x^2\dot{x}^2}{1-x^2}\right)}$$

$$=\int\frac{\dot{x}\sqrt{(1-e^2x^2)}}{\sqrt{(1-x^2)}}.$$

This fluent can only be expreſſed by means of an infinite ſeries, and it has been already given in this form in § 141.

If we take $x=1$, then all the quantities in that ſeries which are multiplied by $\sqrt{(1-x^2)}$ will vaniſh, but in this particular caſe z is the elliptic quadrant EA, and A is a quadrant of the circumſcribing circle, or $\frac{1}{2}\pi$, therefore the elliptic quadrant is equal to

$$\tfrac{1}{2}\pi\left(1-\frac{1}{2.2}e^2-\frac{1.1.3}{2.2.4.4}e^4-\frac{1.1.3.3.5}{2.2.4.4.6.6}e^6-\&c.\right)$$

This ſeries converges very faſt if e be a ſmall fraction.

Fig. 11. *Ex.* 4. Suppoſe the curve to be a cycloid. Let a circle be deſcribed on its axis meeting the ordinate PB in Q, and draw CQ to the centre of the circle. Put AB$=x$, BP$=y$, the cycloidal arch AP$=z$, the radius AC$=a$, the angle ACQ$=v$, then AB$=a(1-\text{cof. }v)$, BQ$=a$ ſin. v, the circ. arch AQ$=a\,v$, ſo that $x=a(1-\text{cof. }v)$, and from the nature of the curve $y=a(v+\text{ſin. }v)$, therefore (§ 59)

$$\dot{x}=a\dot{v}\,\text{ſin. }v,\quad \dot{y}=a\dot{v}(1+\text{cof. }v),$$

$$\dot{x}^2+\dot{y}^2=a^2\dot{v}^2\left\{\text{ſin.}^2 v+(1+\text{cof. }v)^2\right\}$$

$$=a^2\dot{v}^2(2+2\,\text{cof. }v)$$

but $2+2$ cof. $v=4$ cof.$^2\frac{1}{2}v$ (ALGEBRA, § 356.), therefore

$$z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}=2a\int\dot{v}\,\text{cof. }\tfrac{1}{2}v$$

$$=4a\,\text{ſin. }\tfrac{1}{2}v+C,\ (\S\ 145.)$$

but as when $v=0$, then $z=0$, therefore $C=0$, and $z=4a$ ſin. $\frac{1}{2}v$; but if the chord AQ be drawn, $2a$ ſin. $\frac{1}{2}v$ = chord AQ, therefore $z=2$ chord AQ.

162. The formula $z=\int\sqrt{(\dot{x}^2+\dot{y}^2)}$ not being applicable in its preſent form to curves of the ſpiral kind, we ſhall here inveſtigate another ſuited to that particular claſs of curves.

Fig. 30. Let APR be a curve of ſuch a nature that the poſition of any point P in the curve is determined by PF, its diſtance from a given point F, and by the angle which PF makes with AF a line given in poſition. We ſhall employ the ſame conſtruction and notation here as in § 154, with the addition of drawing the chords DD′, PQ, PP′, and putting the arch AP$=z$; then it is manifeſt that the ſimultaneous increments of v, z, and r will be the arches DD′, PP′, and the ſtraight line P′Q reſpectively. Hence

$$\frac{\dot{z}}{\dot{v}}=\text{limit of }\frac{\text{arch PP}'}{\text{arch DD}'}$$

but it is evident from § 62, that the limiting ratio of thoſe arches muſt be the ſame as that of their chords, therefore, Inverſe Method.

$$\frac{\dot{z}}{\dot{v}}=\text{limit of }\frac{\text{chord PP}'}{\text{chord DD}'};$$

now the limit of the angle PQD being evidently a right angle, we have

$$\text{lim. }\frac{\text{PP}'}{\text{DD}'}=\text{lim. }\frac{\sqrt{(\text{PQ}^2+\text{QP}'^2)}}{\text{DD}'}$$

$$=\text{lim. }\sqrt{\left\{\frac{\text{PQ}^2}{\text{DD}'^2}+\frac{\text{P}'\text{Q}^2}{\text{DD}'^2}\right\}}$$

but $\frac{\text{PQ}^2}{\text{DD}'^2}=\frac{\text{FP}^2}{\text{FD}^2}=r^2$, and lim. $\frac{\text{P}'\text{Q}^2}{\text{DD}'^2}=\frac{\dot{r}^2}{\dot{v}^2}$, therefore

$$\frac{\dot{z}}{\dot{v}}=\sqrt{\left(r^2+\frac{\dot{r}^2}{\dot{v}^2}\right)},\ \text{and } \dot{z}=\sqrt{\left(r^2\dot{v}^2+\dot{r}^2\right)}.$$

Let us apply this formula to the ſpiral of Archimedes, Fig. 27. the equation of which (§ 155.) is $a\,m\,v=n\,r$, and therefore

$$v=\frac{nr}{am},\ \text{and } \dot{v}^2=\frac{n^2\dot{r}^2}{a^2m^2};\ \text{hence}$$

$$z=\int\sqrt{(\dot{r}^2+r^2\dot{v}^2)}=\frac{1}{a}\int\dot{r}\sqrt{(a^2+\frac{n^2}{m^2}r^2)}$$

This fluent may be found by formula B, § 131, and it is worthy of remark that the fluxion has the ſame form as that which we have found in § 161 for an arch of a parabola; thus the length of any portion of the ſpiral of Archimedes may be exhibited by means of an arch of a parabola.

To find the Content of Solids.

163. If AD the abſciſſa of a curve be denoted by x, Fig. 4. and PD the ordinate by y, and the ſolid generated by the revolution of the curve APD about AD as an axis by s, it has been ſhewn, in § 64, that $\dot{s}=\pi y^2\dot{x}$, therefore the general formula for finding the content of a ſolid is

$$s=\pi\int y^2\dot{x}.$$

Ex. 1. Suppoſe the ſolid to be a paraboloid, or that which is generated by the revolution of a parabola about its axis; in this caſe $y^2=a\,x$, and taking the fluent ſo that when $x=0$, then $s=0$,

$$s=\pi\int y^2\dot{x}=\pi a\int x\,\dot{x}=\tfrac{1}{2}\pi a x^2.$$

or $s=\frac{1}{2}\pi x y^2$; but $\pi x y^2$ is the content of a cylinder having y for the radius of its baſe and x for its altitude, therefore the content of a paraboloid is half that of a cylinder having the ſame baſe and altitude.

Ex. 2. Suppoſe the ſolid to be a parabolic ſpindle, Fig. 31. which is generated by the revolution of APB an arch of a parabola about AC an ordinate to its axis. In this caſe let AD$=x$, DP$=y$, AB$=b$, the parameter of the

Inverſe Method.

axis $=a$, then from the nature of the parabola $AD \times DB = a \times PD$, that is $x(b-x)=ay$, hence $y=\frac{(b-x)x}{a}$, and taking the fluent, ſo that s and x may vaniſh together;

$$s=\pi\int y^2\dot{x}=\frac{\pi}{a^2}\int x^2(b-x)^2\dot{x}$$

$$=\frac{\pi}{a^2}\int(b^2x^2\dot{x}-2bx^3\dot{x}+x^4\dot{x})$$

$$=\frac{\pi}{a^2}\left(\frac{b^2x^3}{3}-\frac{bx^4}{2}+\frac{x^5}{5}\right)$$

or, ſince $a^2=\frac{(b-x)^2x^2}{y^2}$,

$$s=\frac{\pi y^2}{(b-x)^2}\left\{\frac{b^2x}{3}-\frac{bx^2}{2}+\frac{x^3}{5}\right\},$$

which expreſſion (by ſuppoſing $x=AC=\frac{1}{2}b$, and putting d for CE, the greateſt value of y) gives $\frac{4\pi d^2b}{15}$ or the content of half the ſolid generated by the curve AEB, therefore the entire ſpindle is $\frac{8\pi a^2b}{15}$, or (by obſerving that πd^2b is the content of a cylinder having d for the radius of its baſe and b for its length) it is $\frac{8}{15}$ of the circumſcribing cylinder.

Fig. 32. and 33.

Ex. 3. Suppoſe the ſolid to be a ſpheroid produced by the revolution of an ellipſe about either of its axes; put a for $\frac{1}{2}$AB the axis round which the curve revolves, b for $\frac{1}{2}$ E F the other axis, x for AD the height of any ſegment made by a plane perpendicular to the axis of the ſolid, y for PD the radius of its baſe, and s for its content. Then, from the nature of the curve $y^2=\frac{b^2}{a^2}(2ax-x^2)$, therefore, taking the fluent upon the ſuppoſition that s and x vaniſh together,

$$s=\pi\int y^2\dot{x}=\frac{\pi b^2}{a^2}\int(2ax\dot{x}-x^2\dot{x})$$

$$=\frac{\pi b^2}{a^2}\left(ax^2-\frac{x^3}{3}\right).$$

To find the content of the whole ſpheroid we have only to take $x=2a$, thus the formula becomes $s=\frac{4\pi b^2a}{3}$, and as $2\pi b^2a$ expreſſes the content of a cylinder having $2b$ for the diameter of its baſe, and $2a$ for its height, it follows that the content of a ſpheroid is $\frac{2}{3}$ that of its circumſcribing cylinder.

It is obvious that what has been found for the ſpheroid will apply alſo to the ſphere, by ſuppoſing the axes equal, or $a=b$.

Fig. 4.

164. If inſtead of ſuppoſing the ſolid APQ p to be formed by the revolution of a curve round its axis (in which caſe it is called a ſolid of *revolution*) we had ſuppoſed it to have any figure whatever, then by referring the ſolid to ſome ſtraight line AC, given by poſition, as an axis, and in which A is a given point, and ſuppoſing PQ p to be a ſection of the ſolid made by a plane perpendicular to that axis, meeting it in D, and putting AD$=x$, and the variable ſolid APQ p (conſidered as a function of x) $=s$, by proceeding as in § 64, we would have found the limit of $\frac{\text{increment of } s}{\text{increment of } x}$, and conſequently $\frac{\dot{s}}{\dot{x}}$, equal to the area of the ſection of the ſolid made by the plane PQ p; therefore, putting V for that function of x which expreſſes the area of the ſection, we have $\dot{s}=V\dot{x}$, and $s=\int V\dot{x}$.

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Let us ſuppoſe for example that AEFG is a ſolid bounded by any plane figure EFG as a baſe, and by the ſurface which will be generated if we ſuppoſe a ſtraight line drawn from A any given point above that plane to revolve in the circumference of the baſe. Fig. 34.

Let AC be a perpendicular drawn from the vertex of the figure to its baſe, and let PQ p be a ſection of the ſolid by a plane parallel to the baſe, meeting the perpendicular in D. Put $a=$ the area of the baſe of the ſolid, V$=$ the area of the ſection PQ p, $b=$AC the altitude of the whole ſolid, $x=$AD the altitude of the part cut off by the plane PQ p, and $s=$ the content of that part; then, as from the nature of the ſolid it is pretty evident that the part of it cut off by the plane PQ p is ſimilar to the whole, and as the baſes of ſimilar ſolids are as the ſquares of their altitudes, we have $a : V :: b^2 : x^2$, hence $V=\frac{ax^2}{b^2}$, and

$$s=\int V\dot{x}=\frac{a}{b^2}\int x^2\dot{x}=\frac{ax^3}{3b^2},$$

this expreſſion for s does not require the addition of any conſtant quantity, for by putting $x=0$, we have $s=0$ as it ought to be. Suppoſe now $x=b$, then $s=\frac{ab^3}{3b^2}=\frac{1}{3}ab$, from which it appears that the content of the whole ſolid is $\frac{1}{3}$ of the product of the baſe by the perpendicular. It is evident that pyramids and cones are ſolids of the kind we have been conſidering.

To find the Surfaces of Solids.

165. The altitude AD of a ſolid, generated by revolution of a curve about AD as an axis, being as before denoted by x, and PD the radius of its baſe by y, let us now put s to denote the curved ſurface of the ſolid, then, as it has been ſhewn, § 65, that $\dot{s}=2\pi y\sqrt{(\dot{x}^2+\dot{y}^2)}$, we have Fig. 5.

$$s=2\pi\int y\sqrt{(\dot{x}^2+\dot{y}^2)}$$

as a general formula for the ſurface of a ſolid.

Ex. 1. Suppoſe the ſolid to be a ſphere, generated by the revolution of a circle about its diameter AB, put the radius of the ſphere $=a$, then, AD being denoted by x, and PD by y, we have from the nature of the curve $y^2=2ax-x^2$, therefore Fig. 35.

$$y=\sqrt{(2ax-x^2)}, \text{ and } \dot{y}=\frac{(a-x)\dot{x}}{\sqrt{(2ax-x^2)}}, \text{ and}$$

$\dot{x}^2$

Inverſe Method.

$$\dot{x}^2+\dot{y}^2=\dot{x}^2\left(1+\frac{(a-x)^2}{2ax-x^2}\right)$$

$$=\frac{a^2\dot{x}^2}{2ax-x^2}=\frac{a^2\dot{x}^2}{y^2},$$

therefore, $y\sqrt{(\dot{x}^2+\dot{y}^2)}=a\dot{x}$, and taking the fluent, ſo that when $x=0$, then $s=0$,

$$s=2\pi\int y\sqrt{(\dot{x}^2+\dot{y}^2)}=2\pi ax;$$

now if it be conſidered that $2\pi a$ is the circumference of a great circle of the ſphere, it will immediately appear that the ſurface of a ſegment of a ſphere is equal to the circumference of a great circle of the ſphere multiplied into the height of the ſegment. Hence it follows that the whole ſurface of the ſphere is equal to four times the area of one of its great circles.

Fig. 5. *Ex.* 2. Suppoſe the curve to be a parabola, then putting AD$=x$, DP$=y$, the parameter of the axis $=a$, we have (§ 161. example 1.)

$$\sqrt{(\dot{x}^2+\dot{y}^2)}=\frac{1}{a}\dot{y}\sqrt{(a^2+4y^2)}, \text{ therefore}$$

$$s=2\pi\int y\sqrt{(\dot{x}^2+\dot{y}^2)}$$

$$=\frac{2\pi}{a}\int y\dot{y}\sqrt{(a^2+4y^2)}$$

$$=\frac{\pi}{6a}(a^2+4y^2)^{\frac{3}{2}}+C, \text{ by § 108.}$$

To diſcover the value of the conſtant quantity C, we muſt obſerve that when $x=0$, then $y=0$, and $s=0$, therefore, putting 0 inſtead of s and y, the above equation becomes $0=\frac{\pi a^3}{6}+C$, hence $C=-\frac{\pi a^3}{6}$, and

$$s=\pi\left\{\frac{(a^2+4y^2)^{\frac{3}{2}}-a^3}{6a}\right\}.$$

To find the Centre of Gravity of any Line, Surface, or Solid.

166. It belongs to the theory of MECHANICS to explain what is meant by the centre of gravity, and to demonſtrate its general properties, and here it is only neceſſary to ſhew how the method of fluxions may be applied to deduce from ſome one of thoſe properties rules for finding that centre in any propoſed caſe.

The property of centres of gravity which we ſhall employ as the foundation of the application of the method of fluxions to its determination may be enunciated ſhortly thus.

Fig. 36. Let C be the centre of gravity of a maſs of matter denoted by M, and c the centre of gravity of another maſs m, and D the centre of gravity of the two maſſes M and m, from theſe points let perpendiculars CA, ca, DE be drawn to any ſtraight line PQ, then

$$M\times CA+m\times ca=(M+m)\times DE.$$

Fig. 27. 167. Let us now ſuppoſe that AP is any curve line (having weight,) of which the centre of gravity is required, and that PB, PD are co-ordinates drawn from any point in the curve perpendicular to AB, AD two axes at right angles to each other; let the arch AP receive any increment Pp, let C be the centre of gravity of AP, G the centre of gravity of Pp, and C′ the centre of gravity of APp. From C and G draw CE, CF, GH, GK perpendicular to the axes AB, AD. Put PD$=v$, PB$=y$, CF$=X$, CE$=Y$, AP$=z$, alſo let the arch AP$p=z'$, and let the diſtances of C′ its centre of gravity from the axes AD, AB be denoted by X', and Y' reſpectively; then, obſerving that the arch P$p=z'-z$, by the propoſition in laſt §,

$$zX+(z'-z)\times GK=z'X'$$

$$\text{hence } \frac{z'X'-zX}{z'-z}=GK;$$

If we now ſuppoſe the arch Pp to be continually diminiſhed, and obſerve that $z'X'-zX$, and $z'-z$ are the ſimultaneous increments of zX and z, it will appear (§ 23.) that

$$\frac{\text{flux. of } (zX)}{\dot{z}}=\text{limit of GK.}$$

By the very ſame way of reaſoning we find

$$\frac{\text{flux. of } (zY)}{\dot{z}}=\text{limit of GH,}$$

but the point p approaching to P, it is manifeſt that the point G will alſo approach to P, ſo that the limit of GK is PD or x, and the limit of GH is PB or y, hence

$$\frac{\text{flux.}(zX)}{\dot{z}}=x,\quad \frac{\text{flux.}(zY)}{\dot{z}}=y,$$

$$\text{flux. } (zX)=x\dot{z}\quad \text{flux. } (zY)=y\dot{z}$$

Taking now the fluents of each ſide of theſe equations, and dividing by z,

$$X=\frac{\int x\dot{z}}{z},\quad Y=\frac{\int y\dot{z}}{z};$$

It is evident that by theſe two equations the poſition of C the centre of gravity is determined.

168. Let us next ſuppoſe that it is required to find C Fig. 37. the centre of gravity of the plane area APB. As the arch AP was in laſt § ſuppoſed to receive the increment Pp, ſo let the area APB now receive the increment BPpb, and let C, C′ and G (which in the former caſe were ſuppoſed to be the centres of gravity of the arches AP, APp, and Pp reſpectively) now be ſuppoſed to be the centres of gravity of the areas APB, Apb, and BPpb; put the area APB$=s$, the area A$pb=s'$, and let X, Y, X′, Y′ denote as before, Then, reaſoning exactly as in laſt caſe, we have (by § 166.),

$$sX+(s'-s)\times GK=s'X'$$

$$sY+(s'-s)\times GH=s'Y'$$

hence

hence

$$\frac{s'X'-sX}{s'-s}=GK,\ \frac{s'Y'-sY}{s'-s}=GH;$$

and the point p being ſuppoſed to approach to P, ſo that $s'X'-sX$, $s'Y'-sY$, and $s'-s$, the ſimultaneous increments of X, Y and s, may be continually diminiſhed,

$$\frac{\text{flux.}(sX)}{\dot{s}}=\text{lim. GK},\ \frac{\text{flux.}(sY)}{\dot{s}}=\text{lim. GH};$$

but as the ordinate pb approaches to PB, it is manifeſt that the ultimate poſition of G the centre of gravity of the area BPpb will be the middle of PB, therefore the limit of GK is x, and the limit of GH is $\frac{1}{2}y$, thus we have

$$\frac{\text{flux.}(sX)}{\dot{s}}=x,\ \frac{\text{flux.}(sY)}{\dot{s}}=\tfrac{1}{2}y,$$

and conſequently,

$$X=\frac{\int x\dot{s}}{s},\ Y=\frac{\int y\dot{s}}{2s},$$

or ſince $\dot{s}=y\dot{x}$, and $s=\int y\dot{x}$ (§ 61.),

$$X=\frac{\int yx\dot{x}}{\int y\dot{x}},\ Y=\frac{\int y^2\dot{x}}{2\int y\dot{x}}.$$

Fig. 37.

169. Let it next be required to find the centre of gravity of the ſurface of a ſolid generated by the revolution of the curve AP about AB as an axis. Let the ſurface of the ſolid be conceived to receive an increment generated by Pp an arch of the curve. In this caſe it is evident that the centres of gravity of the ſurface generated by the curve AP, the ſurface generated by the curve APp, and the ſurface generated by the arch Pp, will each be in AB, the axis of the ſolid; ſuppoſe them to be at E, E′ and H reſpectively. Put AE=X, AE′=X′, alſo put s for the ſurface generated by AP, and s' for the ſurface generated by APp, then as before (from § 166.) we have

$$sX+(s'-s)\,AH=s'X',$$

$$\text{hence}\quad \frac{s'X'-sX}{s'-s}=AH,$$

$$\text{and}\quad \frac{\text{flux.}(sX)}{\dot{s}}=\text{lim. AH}.$$

but the point p approaching to P, the limit of AH is manifeſtly AB or x, therefore

$$\frac{\text{flux.}(sX)}{\dot{s}}=x,\ \text{and}\ X=\frac{\int x\dot{s}}{s},$$

ſince $\dot{s}=2\pi y\dot{z}$ (§ 65.),

$$X=\frac{2\pi\int xy\dot{z}}{2\pi\int y\dot{z}}=\frac{\int xy\dot{z}}{\int y\dot{z}}.$$

Inverſe Method.

170. If inſtead of the centre of gravity of the ſurface generated by AP, the centre of gravity of the ſolid generated by the revolution of the plane figure APB about AB as an axis be required, the reaſoning will be the very ſame as in laſt §, ſubſtituting the ſolid generated by the plane figure inſtead of the ſurface generated by the curve line; ſo that putting s for the content of the ſolid, and X for AE the diſtance of its centre of gravity from the vertex, we have alſo

$$X=\frac{\int xs}{s},$$

but in this caſe $\dot{s}=\pi y^2\dot{x}$ (§ 64.), therefore

$$X=\frac{\pi\int y^2x\dot{x}}{\pi\int y^2\dot{x}}=\frac{\int y^2x\dot{x}}{\int y^2\dot{x}}.$$

171. We ſhall now apply theſe formulas to ſome examples.

Example. 1. Let it be required to find the centre of gravity of AP an arch of a circle. Suppoſe AB to be a part of the diameter, and in addition to the notation of § 167. put a for the radius of the circle, then from the nature of the curve, $y^2=2ax-x^2$, hence (proceeding as in § 165. Ex. 1.) we have $\dot{z}=\frac{a\dot{x}}{y}$ and therefore $\dot{z}y=a\dot{x}$, and $\dot{z}x=\frac{ax\dot{x}}{y}$, but from the equation $y^2=2ax-x^2$, by taking the fluxions we get $y\dot{y}=a\dot{x}-x\dot{x}$, and hence $\frac{x\dot{x}}{y}=\frac{a\dot{x}}{y}-\dot{y}=\dot{z}-\dot{y}$, therefore $\dot{z}x=a(\dot{z}-\dot{y})$; ſubſtituting now the values of $\dot{z}x$ and $\dot{z}y$ in the formula of § 167 we have

Fig. 37.

$$X=\frac{\int x\dot{z}}{z}-\frac{a}{z}\int(\dot{z}-\dot{y})$$

$$=\frac{a}{z}(z-y+c)$$

$$Y=\frac{\int y\dot{z}}{z}=\frac{a}{z}\int\dot{x}$$

$$=\frac{a}{z}(x+c').$$

To diſcover the values of the conſtant quantities c, c', we have from the equations in which they occur,

$$ac=Xz-az+ay,\quad ac'=Yz-ax;$$

but when $z=0$, then x, y, X and Y are each $=0$, therefore $c=0$, and $c'=0$, thus we have ſimply

$$X=\frac{a(z-y)}{z},\ Y=\frac{ax}{z}.$$

Ex. 2.

Inverse Method.

Ex. 2. Let it be required to find the centre of gravity of APB an area bounded by AP an arch of a circle and PB, BA its ſine and verſed ſine. Let a denote the radius, and let the remaining notation be as in § 168. Then, becauſe $\dot{s}=y\dot{x}$ we have $x\dot{s}=yx\dot{x}$, but from the equation $y^2=2ax-x^2$ (which expreſſes the nature of the curve), we find

Fig. 57.

$$x\dot{x}=a\dot{x}-y\dot{y}, \text{ therefore}$$

$$x\dot{s}=ay\dot{x}-y^2\dot{y}=a\dot{s}-y^2\dot{y}.$$

We have alſo $y\dot{s}=y^2\dot{x}=(2ax-x^2)\dot{x}$, therefore,

$$X=\frac{\int x\dot{s}}{s}=\frac{\int(a\dot{s}-y^2\dot{y})}{s}$$

$$=\frac{1}{s}(as-\tfrac{1}{3}y^3+c)$$

$$Y=\frac{\int y\dot{s}}{2s}=\frac{\int(2ax-x^2)\dot{x}}{2s}$$

$$=\frac{1}{2s}(ax^2-\tfrac{1}{3}x^3+c')$$

By proceeding as in the laſt example we find c and c' each $=0$, thus we have

$$X=a-\frac{y^2}{3s},\quad Y=\frac{3ax^2-x^3}{6s}.$$

Fig. 57.

Ex. 3. Suppoſe now the figure to be the ſurface generated by the revolution of AP an arch of a circle about the diameter AB, and that the centre of gravity of the generated ſurface is required. Then becauſe from the nature of the circle $\dot{z}=\frac{a\dot{x}}{y}$ we have $y\dot{z}=a\dot{x}$, and $xy\dot{z}=ax\dot{x}$, therefore, ſubſtituting theſe values in the formula of § 169 it becomes

$$X=\frac{\int xy\dot{z}}{\int y\dot{z}}=\frac{\int x\dot{x}}{a\int\dot{x}}$$

$$=\frac{\frac{1}{2}x^2+c}{x+c'}.$$

To find the values of the conſtant quantities c, c', we have

$$c=X(x+c')-\tfrac{1}{2}x^2,$$

$$c'=\frac{\frac{1}{2}x^2+c}{X}-x,$$

but as when $x=0$, then $X=0$, it is manifeſt that c and c' are each $=0$, thus we have

$$X=\tfrac{1}{2}x.$$

Fig. 57.

Ex. 4. Let us now ſuppoſe that it is required to find the centre of gravity of the ſolid generated by the revolution of AP an arch of a circle about the diameter. In this caſe, becauſe $y^2=2ax-x^2$, we have from § 170,

Inverſe Method.

$$X=\frac{\int y^3x\dot{x}}{\int y^3\dot{x}}=\frac{\int\dot{x}(2ax^2-x^3)}{\int x(2ax-x^2)}$$

$$=\frac{\frac{2}{3}ax^3-\frac{1}{4}x^4+c}{ax^2-\frac{1}{3}x^3+c'},$$

and reaſoning as in the laſt example, we find $c=0$, and $c'=0$, and therefore

$$X=\frac{8ax-3x^2}{12a-4x}.$$

If the ſegment be a hemiſphere, in which caſe $x=a$, then $X=\frac{5}{8}a$.

Sect. III. *Of Fluxional Equations.*

172. It has been ſhewn, (§ 49.) how, from an equation being given, expreſſing the relation between x a variable quantity, and y a function of that quantity, we may deduce the equation that expreſſes the relation of their fluxions. We are now to ſhow how from the latter, or *fluxional equation*, we may return to the equation of the fluents, which, relatively to the other, may be called its *primitive equation*.

173. As any primitive equation and the fluxional equation derived from it both hold true at the ſame time, and as the conſtant quantities which enter into the former retain the ſame values in the latter, it follows that by means of the two equations we may exterminate any one of the conſtant quantities, and thus from any propoſed primitive equation deduce a fluxional equation, in which one of the conſtant quantities contained in that primitive ſhall not at all be found.

For example let the primitive equation be $y+ax+b=0$, by taking the fluxions we have $\dot{y}+a\dot{x}=0$, a fluxional equation in which b is not found; if however it be required to find an equation in which a ſhall be wanting, we have only to eliminate a by applying the common rules of algebra (Algebra, Sect. vii.) to the two equations

$$y+ax+b=0,\quad \dot{y}+a\dot{x}=0,$$

and hence we have $y\dot{x}-x\dot{y}+b\dot{x}=0$, thus it appears that from the primitive equation $y+ax+b=0$ we may deduce a fluxional equation which may be expreſſed under either of theſe forms

$$\dot{y}+a\dot{x}=0,\quad y\dot{x}-x\dot{y}+b\dot{x}=0;$$

theſe hold true at the ſame time as the primitive equation, they are alike related to it, and any two of the three being given the other neceſſarily follows from them.

As a ſecond example, ſuppoſe the primitive equation to be $x^2-2ay-a^2-b=0$, by paſſing to the fluxions we immediately find $x\dot{x}-a\dot{y}=0$ an equation in which b is not found. If, however, it be required that the fluxional equation ſhall want a, we have only to apply the common rules of elimination to the two equations; thus from the ſecond we get $a=\frac{x\dot{x}}{\dot{y}}$, and this being ſubſtituted in the firſt it becomes

x^2

Inverse Method.

$$\dot{x}^2-\frac{2xy\dot{x}}{\dot{y}}-\frac{x^2\dot{x}^2}{\dot{y}^2}-b=0$$

from which we have

$$(\dot{x}^2-b)\dot{y}^2-2xy\dot{y}\dot{x}-x^2\dot{x}^2=0$$

and taking the square root, having previously reduced the equation to a proper form,

$$\dot{y}\sqrt{(x^2+y^2-b)}-y\dot{y}-x\dot{x}=0.$$

174. It is evident that by proceeding in this manner we shall, in some cases, arrive at a fluxional equation involving the second and higher powers of $\frac{\dot{y}}{\dot{x}}$, and when this happens we can only find the value of $\frac{\dot{y}}{\dot{x}}$ by the resolution of an equation; but this may be avoided by preparing the primitive equation in such a manner, that the constant quantity to be eliminated may be entirely separated from the variable quantities, so as to form one of the terms of the equation, then, upon taking the fluxions, this term being constant will vanish, and thus we shall obtain an equation entirely free from the constant quantity contained in that term. Thus the primitive equation $y+ax+b=0$ has already such a form that by taking the fluxions we get $\dot{y}+a\dot{x}=0$ an equation in which b is not found. If it be required, that upon taking the fluxions, a shall vanish; we must put the equation under this form $\frac{y+b}{x}+a=0$, and then taking the fluxion, we find immediately

$$\frac{x\dot{y}-(y+b)\dot{x}}{x^2}=0,$$

an expression in which a is not found, and which by rejecting the divisor x^2 becomes $y\dot{x}-x\dot{y}+b\dot{x}=0$, and these two forms of the fluxional equation are the very same as have been found in the last §. In the second example, viz. $x^2-2ay-a^2-b=0$, the equation has already the form suited to the elimination of b, for the fluxional equation is $x\dot{x}-a\dot{y}=0$, but in order that a may vanish, we must resolve the equation with respect to a, so as to give it this form

$$y-\sqrt{(x^2+y^2-b)}+a=0;$$

passing now to the fluxional equation, a disappears, and we have

$$\frac{\dot{y}\sqrt{(x^2+y^2-b)}-y\dot{y}-x\dot{x}}{\sqrt{(x^2+y^2-b)}}=0$$

It is evident that we have only to reject the denominator to give the equation this form

$$\dot{y}\sqrt{(x^2+y^2-b)}-y\dot{y}-x\dot{x}=0$$

the same as was found in the conclusion of last §.

175. From what has been now shewn we may infer that as from any proposed primitive equation we can deduce a fluxional equation that shall contain one constant quantity less than the primitive contains, so on the contrary any fluxional equation being given, its primitive equation may contain one constant quantity more than the fluxional equation, but it can contain only one, for no more than one constant quantity can be made to disappear by returning from the primitive to its fluxional equation. Inverse Method.

176. The fluxional equation expressing the value of $\frac{\dot{y}}{\dot{x}}$, which is derived from any primitive equation involving x, and y a function of x, may be called a fluxional equation of the *first order*; and as from this equation considered as a primitive, we may in like manner derive an equation that shall involve $\frac{\ddot{y}}{\dot{x}^2}$ (§ 50.), this last may be called a fluxional equation of the *second order*, and the fluxional equation from which it is derived may be called its primitive equation of the *first order*, to distinguish it from the absolute primitive equation, from which all the others are conceived to be derived. A similar mode of definition is to be applied to the higher orders.

177. As any primitive equation and the fluxional equations of the first and second orders derived from it must all hold true at the same time, it is evident, that by means of the three equations, we may exterminate any two of the constant quantities contained in them that we please, and thus produce a fluxional equation of the second order that contains two constant quantities less than the primitive equation. There are however two other ways by which we may arrive at the very same fluxional equation of the second order. For as from the given primitive equation we may deduce two different fluxional equations of the first order, one of which shall contain one only of the two quantities to be eliminated, and the other shall contain the other quantity only, we may consider each of these equations in its turn as a primitive, and, by proceeding in the manner explained in § 173 and § 174, derive from it a fluxional equation, in which that particular constant quantity which remained in its primitive, but which was to be finally eliminated, shall not be found; thus, from each of these primitives we shall deduce the very same fluxional equation of the second order, that shall be freed from two of the constant quantities contained in the absolute primitive equation.

Let us take for example the equation

$$x^2-2ay+b^2=0;$$

by proceeding as explained in § 173, or § 174, we find these two fluxional equations of the first order,

$$x\dot{x}-a\dot{y}=0,\quad (x^2+b^2)\dot{y}-2xy\dot{x}=0,$$

in the one of these, the constant quantity a is wanting, and in the other b is wanting. Taking the first equation $x\dot{x}-a\dot{y}=0$, and proceeding as in § 50 (observing that $\dot{x}$ is constant) we find $\dot{x}^2-a\ddot{y}=0$, if from this equation we now eliminate a by putting instead of it $\frac{x\dot{x}}{\dot{y}}$ (deduced from the equation $x\dot{x}-a\dot{y}=0$) we find after proper reduction

$$\ddot{y}x$$

Inverſe Method.

$$\ddot{y}\dot{x}-\dot{x}\dot{y}=0,$$

a fluxional equation of the ſecond order, in which both a and b are wanting, and having $x^2-2ay+b^2$ for its abſolute primitive equation.

Let us now take the other fluxional equation of the firſt order which involves b, viz. $(x^2+b^2)\dot{y}-2xy\dot{x}=0$; by proceeding with this as with the former we find $(x^2+b^2)\ddot{y}-2y\dot{x}^2=0$; from the firſt of theſe equations we find $x^2+b^2=\frac{2xy\dot{x}}{\dot{y}}$, and from the ſecond $x^2+b^2=\frac{2y\dot{x}^2}{\ddot{y}}$; therefore, $\frac{2xy\dot{x}}{\dot{y}}=\frac{2y\dot{x}^2}{\ddot{y}}$, and hence we have

$$\ddot{y}\dot{x}-\dot{x}\dot{y}=0$$

the ſame equation as before; and as we have arrived at the very ſame concluſion by conſidering each of theſe equations

$$x\dot{x}-a\dot{y}=0,\quad (x^2+b^2)\dot{y}-2xy\dot{x}=0$$

as a primitive, it follows that both theſe are to be conſidered as primitive equations of the firſt order of the fluxional equation $\ddot{y}\dot{x}-\dot{x}\dot{y}$.

178. In general, every fluxional equation of the ſecond order has two primitive equations of the firſt order, and all three may be conſidered as originating from one and the ſame abſolute primitive equation; and as a fluxional equation of the ſecond order may contain two conſtant quantities leſs than its abſolute primitive equation, and one leſs than either of its primitive equations of the firſt order; ſo, on the contrary, a primitive equation of the firſt order may contain one conſtant quantity more than the fluxional equation of the ſecond order derived from it, and the abſolute primitive may contain two conſtant quantities which are not found in the fluxional equation of the ſecond order derived from it; and ſimilar concluſions may be drawn relating to fluxional equations of the third or any higher order.

Of Fluxional Equations of the firſt order.

179. When it is required to find the primitive equation correſponding to a propoſed fluxional equation of the firſt order, we may endeavour to ſeparate the variable quantities, that is, to bring the equation to ſuch a form, that it may be compoſed of two parts, one of which conſiſts of $\dot{x}$ multiplied or divided by a function of x only, and the other of $\dot{y}$ multiplied or divided by a function of y only. When this ſeparation of the variable quantities can be effected, we have only to take the fluents according to the methods explained in SECT. I. and put their ſum $=0$, and we immediately have the primitive equation required.

Ex. Suppoſe the fluxional equation to be

$$my\dot{x}+nx\dot{y}=0$$

divide the terms of the equation by xy, and it becomes

$$\frac{m\dot{x}}{x}+\frac{n\dot{y}}{y}=0.$$

Now the fluent of $\frac{m\dot{x}}{x}$ is $m\,\text{l.}\,x+c'$ (§ 103.) and in like manner the fluent of $\frac{n\dot{y}}{y}$ is $n\,\text{l.}\,y+c''$, therefore

$$m\,\text{l.}\,x+n\,\text{l.}\,y+c'+c''=0,$$

or, tranſpoſing $c+c''$, and putting a ſingle conſtant quantity for their ſum, which, to be homogeneous with the logarithmic quantities may be $-\log.c$, or $-\text{l.}\,c$,

$$m\,\text{l.}\,x+n\,\text{l.}\,y=\text{l.}\,c,\ \text{or l.}\,(x^m)+\text{l.}\,(y^n)=\text{l.}\,c,$$

$$\text{or l.}\,(x^my^n)=\text{l.}\,c,\ \text{and hence } x^my^n=c,$$

which laſt is the primitive equation required.

180. When a primitive equation is *homogeneous*, that is when the ſum of the exponents of the variable quantities x and y is the ſame in each term, as in this example,

$$ax\dot{x}+by\dot{x}+dx\dot{y}+ey\dot{y}=0$$

$$\text{or } (ax+by)\dot{x}+(dx+ey)\dot{y}=0$$

in which the variable part of each term is of the firſt degree, as alſo in this equation

$$\left.\begin{aligned}&(ax^2+bxy+dy^2)\dot{x}\\&+(ex^2+fxy+gy^2)\dot{y}\end{aligned}\right\}=0$$

in which the variable part of each term is of the ſecond degree, ſuch an equation may be always transformed into another which will admit of the variable quantities being ſeparated. To take a particular example, let us ſuppoſe the equation to be $x\dot{x}+y\dot{y}=ny\dot{x}$, or $(x-ny)\dot{x}+y\dot{y}=0$. We aſſume $y=xz$ (and the ſame aſſumption is to be made for any other homogeneous equation,) then $\dot{y}=z\dot{x}+x\dot{z}$, thus the equation becomes transformed to

$$(x-nxz)\dot{x}+xz(z\dot{x}+x\dot{z})=0,$$

but as the terms of this equation have a common factor x, by leaving out that factor, it becomes

$$(1-nz)\dot{x}+z(z\dot{x}+x\dot{z})=0$$

which alſo admits of being expreſſed thus

$$(1-nz+z^2)\dot{x}+xz\dot{z}=0,$$

and, by diviſion

$$\frac{\dot{x}}{x}+\frac{z\dot{z}}{1-nz+z^2}=0,$$

and taking the fluents

$$\int\frac{\dot{x}}{x}+\int\frac{z\dot{z}}{1-nz+z^2}=C,$$

where C denotes a conſtant quantity, or, ſince $\int\frac{\dot{x}}{x}=\text{l.}\,x$,

$$\text{l.}\,x+\int\frac{z\dot{z}}{1-nz+z^2}=C,$$

now the particular form of $\int \frac{\dot{z}\dot{z}}{1-nz+z^2}$ depends upon the value of the number n; for if $\frac{n}{2} > 1$, it will be a logarithmic function, and if $\frac{n}{2} < 1$, it will be expreſſible by means of a circle, but if $\frac{n}{2} = 1$, then it is an algebraic function, and in each caſe it may be found by the methods delivered in SECT. 1. for finding the fluent of a rational fraction. It may however, be ſimplified in its form, by obſerving, that ſince

$$\frac{\dot{z}\dot{z}}{1-nz+z^2} = \tfrac{1}{2}\,\frac{2\dot{z}z-n\dot{z}}{1-nz+z^2} + \tfrac{1}{2}\,\frac{n\dot{z}}{1-nz+z^2},$$

$$\text{therefore } (\S\ 103.) \int \frac{\dot{z}\dot{z}}{1-nz+z^2} =$$

$$\tfrac{1}{2}\ \text{l.}\,(1-nz+z^2) + \tfrac{1}{2}\int \frac{n\dot{z}}{1-nz+z^2}.$$

If we limit our enquiry to the caſe of $n=2$, we have

$$\int \frac{n\dot{z}}{1-nz+z^2} = \int \frac{2\dot{z}}{(1-z)^2} = \frac{2}{1-z},$$

let the terms be now collected into one expreſſion, then obſerving that $\frac{1}{2}$ l. $(1-2z+z^2) = \frac{1}{2}$ l. $(1-z)^2 =$ l. $(1-z)$, we have

$$\text{l.}\,x + \text{l.}\,(1-z) + \frac{1}{1-z} = \text{C};$$

and, ſubſtituting $\frac{y}{x}$ inſtead of z,

$$\text{l.}\,x + \text{l.}\left(\frac{x-y}{x}\right) + \frac{x}{x-y} = \text{C},$$

or, ſubſtituting l. c inſtead of C, and collecting the logarithmic functions into one,

$$\text{l.}\,\frac{x-y}{c} = \frac{-x}{x-y}$$

therefore, paſſing from logarithms to numbers, by obſerving that, as when $a = \text{l.}\,p$, we have by the nature of logarithms $e^a = p$, where e denotes the number of which the Napierean logarithm is 1, ſo in the preſent caſe we have $\frac{x-y}{c} = e^{-\frac{x}{x-y}}$, and hence the primitive equation is found to be

$$x-y-c\,e^{-\frac{x}{x-y}} = 0.$$

As a ſecond example let the fluxional equation be

$$x\dot{y} - y\dot{x} = \dot{x}\sqrt{(x^2+y^2)}$$

which is alſo homogeneous. Aſſume as before $y = xz$, then $\dot{y} = x\dot{z} + z\dot{x}$, and ſubſtituting theſe values of y and $\dot{y}$ in the propoſed equation, it becomes

$$\dot{x}\sqrt{(1+z^2)} - x\dot{z} = 0,$$

from which we get

$$\frac{\dot{x}}{x} - \frac{\dot{z}}{\sqrt{(1+z^2)}} = 0,$$

and taking the fluents of the terms, obſerving that each being a logarithm function, their ſum may be put equal to a conſtant logarithm,

$$\text{l.}\,x - \text{l.}\left\{z + \sqrt{(1+z^2)}\right\} = \text{l.}\,c,$$

which expreſſion, by ſubſtituting for z its value $\frac{y}{x}$, becomes

$$\text{l.}\,x = \text{l.}\,c + \text{l.}\left\{\frac{y+\sqrt{(x^2+y^2)}}{x}\right\}.$$

If we now conſider that

$$(y+\sqrt{x^2+y^2})(y-\sqrt{x^2+y^2}) = -x^2,$$

and therefore that

$$\frac{y+\sqrt{(x^2+y^2)}}{x} = \frac{-x}{y-\sqrt{(x^2+y^2)}},$$

it will appear, that the above equation may be otherwiſe expreſſed thus:

$$\text{l.}\,x = \text{l.}\,c + \text{l.}\left\{\frac{-x}{y-\sqrt{(x^2+y^2)}}\right\},$$

from which, by paſſing from logarithms to their numbers, we find $y-\sqrt{(x^2+y^2)} = -c$, and hence, by ſo ordering the equation that the radical may diſappear, we get $x^2 = c^2 + 2cy$, which is the primitive equation required.

181. An equation which is not homogeneous, may in ſome caſes, by proper tranſformations, be rendered homogeneous; this is the caſe in particular with the equation

$$(a+mx+ny)\dot{x} + (b+px+qy)\dot{y} = 0,$$

which is general of its kind; for this purpoſe we aſſume $x = t+\alpha$, and $y = u+\beta$, then $\dot{x} = \dot{t}$, and $\dot{y} = \dot{u}$; by ſubſtituting theſe values of x, y, $\dot{x}$, $\dot{y}$, in the propoſed equation it becomes

$$\left.\begin{array}{l}(a+m\alpha+n\beta+mt+nu)\,\dot{t} \\ +\,(b+p\alpha+q\beta+pt+qu)\,\dot{u}\end{array}\right\} = 0.$$

Let us now ſuppoſe α and β ſuch that

$$a+m\alpha+n\beta = 0,$$

$$b+p\alpha+q\beta = 0,$$

by theſe two equations the values of α and β are determined, and the tranſformed equation is reduced to

$$(mt+nu)\,\dot{t} + (pt+qu)\,\dot{u} = 0,$$

an equation which is homogeneous, and therefore may be treated in the manner explained in laſt §.

This tranſformation will not apply however, when $mq - np = 0$, becauſe then the values of α and β would be infinite.

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infinite. In this case we have $q=\frac{np}{m}$, and therefore $px+qy=\frac{p}{m}(mx+ny)$, hence the original equation may be expressed thus,

$$\left.\begin{matrix} a\dot{x}+b\dot{y} \\ +(mx+ny)(\dot{x}+\frac{p}{m}\dot{y}) \end{matrix}\right\}=0.$$

assume now $mx+ny=z$, then $\dot{y}=\frac{\dot{z}}{n}-\frac{m}{n}\dot{x}$; the values of $mx+ny$ and $\dot{y}$ being now substituted in the equation, and the whole reduced to a proper form, it becomes

$$\dot{x}+\frac{(bm+pz)\dot{z}}{amn-bm^2+(mn-pm)z}=0,$$

The fluent of the second term of this expression will involve logarithms, except that $mn-pm=0$, in which case the primitive equation is

$$x+\frac{2bmz+pz^2}{2(amn-bm^2)}=C.$$

182. When a fluxional equation has this form

$$\dot{y}+Py\dot{x}=Q\dot{x},$$

where P and Q denote any functions of x, the variable quantities may be separated in the following manner. Assume $y=Xz$, then, taking the fluxions, we have $\dot{y}=z\dot{X}+X\dot{z}$, and by substitution, the proposed equation becomes

$$z\dot{X}+X\dot{z}+PXz\dot{x}=Q\dot{x};$$

now as in this equation X and z may be supposed to denote indeterminate functions of x, we may divide it into two others, such, that the variable quantities in each may be separable; to effect this we assume

$$X\dot{z}+PXz\dot{x}=0, \quad z\dot{X}=Q\dot{x};$$

hence, dividing the first equation by X, we have $\dot{z}+Pz\dot{x}=0$, and $\frac{\dot{z}}{z}+P\dot{x}=0$, and taking the fluents, $l.z+\int P\dot{x}=0$, and hence, by passing from logarithms to their numbers,

$$z=e^{-\int P\dot{x}};$$

here no constant quantity is introduced, it being sufficient to add it at the end of the operation; let this value of z be substituted in the second equation, then by deducing from it the value of X we have

$$\dot{X}=e^{\int P\dot{x}}Q\dot{x}$$

and $$X=\int e^{\int P\dot{x}}Q\dot{x}+c$$

and since $y=Xz$, therefore

$$y=e^{-\int P\dot{x}}\left\{\int e^{\int P\dot{x}}Q\dot{x}+c\right\}.$$

Let us take a particular case, and suppose the equation to be $\dot{y}+y\dot{x}=x^n\dot{x}$, then we have $P=1$, $Q=x^n$, and $\int P\dot{x}=x$, hence in this case the general formula becomes

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$$y=e^{-x}\left\{\int e^x x^n\dot{x}+c\right\}.$$

The fluent $\int e^x x^n\dot{x}$ may be found by § 143; let us suppose for example that $n=2$, then we have

$$\int e^x x^2\dot{x}=e^x(x^2-2x+2),$$

so that the fluxional equation being

$$\dot{y}+y\dot{x}=x^2\dot{x},$$

the primitive equation is

$$y=x^2-2x+2+ce^{-x}.$$

The general equation $\dot{y}+Pyx=Q\dot{x}$, which involves the simple power only of the variable quantity y, and its fluxion, has been called a *linear equation* of the first order; it has also, with more propriety, been called a fluxional equation of the *first degree*, and of the first order.

183. The equation

$$\dot{y}+Py\dot{x}=Qy^n\dot{x},$$

where P and Q as before denote any functions of x, is easily reduced to the form we have been considering; for assume $y^{1-n}=(1-n)z$, then $y^{-n}\dot{y}=\dot{z}$, and $\dot{y}=\dot{z}y^n$, and $y=(1-n)zy^n$; if we now substitute the values of $\dot{y}$ and y in the equation, it becomes

$$y^n\dot{z}+(1-n)Pzy^n\dot{x}=Qy^n\dot{x};$$

let the terms of this equation be divided by y^n, then, including the factor $(1-n)$ in the indeterminate function P, the result is

$$\dot{z}+Pz\dot{x}=Q\dot{x}$$

an equation of the very same form as that which has been considered in last §.

184. The most general form that can be given to a fluxional equation of the first order, and consisting of three terms only, is

$$\gamma u^i z^k\dot{z}+\beta u^g z^h\dot{u}=\alpha u^e z^f\dot{u};$$

to give this equation a more simple form let all its terms be divided by $\gamma u^i z^f$, it then becomes

$$z^{k-f}\dot{z}+\frac{\beta}{\gamma}u^{g-i}z^{b-f}\dot{u}=\frac{\alpha}{\gamma}u^{e-i}\dot{u}.$$

Suppose now

$$z^{k-f}\dot{z}=\frac{\dot{y}}{k-f+1}, \quad u^{g-i}\dot{u}=\frac{\dot{x}}{g-i+1},$$

$$\text{then } z^{k-f+1}=y, \quad u^{g-i+1}=x,$$

and $\dot{y}+\frac{(k-f+1)\beta}{(g-i+1)\gamma}\,y^{\frac{h-f}{k-f+1}}\,\dot{x}$

$$=\frac{(k-f+1)\alpha}{(g-i+1)\gamma}\,x^{\frac{e-g}{g-i+1}}\,\dot{x};$$

Let us in order to abridge put

$$\frac{(k-f+1)\beta}{(g-i+1)\gamma}=b,\ \frac{(k-f+1)\alpha}{(g-i+1)\gamma}=a,$$

$$\frac{h-f}{k-f+1}=n,\ \frac{e-g}{g-i+1}=m,$$

then the equation becomes

$$\dot{y}+b\,y^n\dot{x}=a\,x^m\,\dot{x}.$$

If we suppose $n=1$, the resulting equation $\dot{y}+b\,y\,\dot{x}=a\,x^m\,\dot{x}$ may have its variable quantities separated by the method explained in § 183; but if we go only one step farther, and suppose $n=2$ so that the equation is

$$\dot{y}+b\,y^2\,\dot{x}=a\,x^m\,\dot{x},$$

the difficulty of separating the variable quantities *generally* is so great as to have hitherto baffled the utmost efforts of the most expert analysts. This equation is commonly called RICCATI's *equation*, on account of its having been first treated of by an Italian mathematician of that name, who succeeded in separating the variable quantities in some particular cases, namely, when m is equal to $\frac{-4p}{2p\pm1}$, where p denotes any whole positive number.

185. If the separating of the variable quantities generally be a problem of insurmountable difficulty when the equation consists of only three terms, its solution can much less be expected, when the equation consists of four, or any greater number. There are, however, particular cases in which some of the most skilful analysts have, by employing happy and peculiar artifices, succeeded in resolving the problem, but the methods of proceeding are, generally speaking, not reducible to any determinate rules.

186. When the expression which constitutes a fluxional equation is such as would be produced by taking the fluxion of some function of x and y, in which case it may be said to be a complete fluxion, then, without attempting to separate the variable quantities, we have only to add a constant quantity to that function, and the result put $=0$, will evidently be the primitive equation required.

If, for example, the equation be $x\dot{y}+y\dot{x}=0$, it is obvious that the expression $x\dot{y}+y\dot{x}$ is immediately produced by taking the fluxion of the function $x\,y$ (y being also considered as a function of x), therefore the primitive equation is $x\,y+c=0$.

From the view which has been given in § 174. of the origin of fluxional equations it appears, that in passing from a primitive equation to its fluxional equation, the terms of the latter in many cases will not constitute a complete fluxion, by reason of some multiplier, or divisor, which was common to them all, having disappeared. In such cases, however, if we can by any means discover that factor, by restoring it we shall immediately have a complete fluxion, the fluent of which, with the addition of a constant quantity, when put $=0$, will be the primitive equation. Inverse Method.

For example, if the equation be $x\dot{y}-y\dot{x}=0$, here $x\dot{y}-y\dot{x}$ cannot be immediately produced by taking the fluxion of a function of x and y; but, if we divide the equation by x^2 so as to give it this form $\frac{x\dot{y}-y\dot{x}}{x^2}=0$, we obtain the expression $\frac{x\dot{y}-y\dot{x}}{x^2}$ which is a complete fluxion, viz. that of the fraction $\frac{y}{x}$, therefore $\frac{y}{x}+c=0$, or $y+c\,x=0$, is the primitive equation.

In like manner, the equation $m\,x\,\dot{y}+n\,y\,\dot{x}=0$, which does not in its present form express a complete fluxion, yet becomes so when multiplied by $x^{n-1}\,y^{m-1}$, for then it is

$$m\,x^n\,y^{m-1}\,\dot{y}+n\,x^{n-1}\,y^m\,\dot{x}=0$$

from which it appears that the primitive equation in this case must be $x^n\,y^m+c=0$.

187. That we may be able to discover whether the terms of any proposed fluxional equation constitute a complete fluxion, and also from what expression such a fluxion has been derived, we must attend to the process, by which we find the fluxion of an expression composed of two variable quantities, one of which is a function of the other.

To avoid very general reasoning, we shall take for granted what is evidently possible, that any function of x and y may be generally expressed by a formula of this nature.

$$\mathrm{A}\,x^m\,y^n+\mathrm{B}\,x^p\,y^q+\mathrm{C}\,x^r\,y^s+\ \&c.$$

where A, B, C, &c. denote constant quantities, and the exponents m, n, &c. given numbers, the number of terms being supposed either finite or infinite. Now the fluxion of the whole expression is the sum of the fluxions of its terms, but in taking the fluxion of each term, beginning with the first $\mathrm{A}\,x^m\,y^n$, the fluxion of which is

$$m\,\mathrm{A}\,x^{m-1}\,y^n\,\dot{x}+n\,\mathrm{A}\,x^m\,y^{n-1}\,\dot{y},$$

it is evident that the result is composed of two parts, one of which is the expression we would find for its fluxion, if x only were considered as variable, and y as constant, and the other is the expression for its fluxion, if y only were considered as variable and x as constant; hence it follows, that the sum of the fluxions of all the terms will have the very same property; so that, if u be put for the whole expression, we shall in every case have

$$\dot{u}=\mathrm{M}\,\dot{x}+\mathrm{N}\,\dot{y}$$

where $\mathrm{M}\,\dot{x}$ denotes the result that will be found if the fluxion of u be taken upon the hypothesis that x alone,

is

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is variable, and $N\dot{y}$ is the fluxion of u, supposing y alone to be variable.

188. Resuming the consideration of the general expression

$$A x^m y^n + B x^r y^q + C x^s y^t + \&c.$$

let the fluxion of every one of its terms, for example, $A x^m y^n$, be taken, supposing x alone variable, and the result is $mA x^{m-1} y^n \dot{x}$. Again, let the fluxion of this result be taken, supposing y alone variable, and we find it to be $mnA x^{m-1} y^{n-1} \dot{x}\dot{y}$. Now, if we first take the fluxion of $A x^m y^n$, supposing y variable, we get $nA x^m y^{n-1} \dot{y}$, and then, the fluxion of this result, considering x alone as variable, we get $mnA x^{m-1} y^{n-1} \dot{x}\dot{y}$, which is the very same expression as was found by proceeding in a contrary order; and as the same must hold true of all the terms, we may conclude, that if the fluxion of u any function of x and y be taken, considering x only as variable, and then the fluxion of that result, considering y only as variable, the very same final result will be obtained as if we were first to take the fluxion of u supposing y variable, and then the fluxion of that result, supposing x variable; but the fluxion of u being expressed thus, $M\dot{x}+N\dot{y}$, it has been shewn that $M\dot{x}$ is the fluxion of u, if x only be supposed variable, and $N\dot{y}$ is its fluxion, if y only be variable, therefore, if we take the fluxion of $M\dot{x}$ upon the supposition that y only is variable, also the fluxion of $N\dot{y}$ upon the supposition that x only is variable, the results must be identical. This property affords the following rule, by which we may always determine whether any proposed expression constitutes an exact fluxion or not. *Let the expression be put under this form* $M\dot{x}+N\dot{y}$; *let* $M'\dot{y}$ *be the fluxion of* M, *supposing* y *alone variable, and* $N'\dot{x}$ *the fluxion of* N *supposing* x *alone variable, then, if* M′ *and* N′ *are identical,* $M\dot{x}+N\dot{y}$ *is a complete fluxion; and if they are not,* $M\dot{x}+N\dot{y}$ *is not a complete fluxion.*

189. It is easy to see, how, from a complete fluxion $\dot{u}=M\dot{x}+N\dot{y}$ we may determine u its fluent; for as $M\dot{x}$ has been deduced from u by considering x as variable, and y as constant, on which account all the terms of u that involved y only must have vanished, it follows on the contrary, that if we put Y to denote those terms, we shall have

$$u=\int M\dot{x}+Y$$

the fluent of $M\dot{x}$ being taken, regarding x only as variable. The function Y may be determined, by comparing the fluxion of the expression thus obtained with the given fluxion $M\dot{x}+N\dot{y}$.

Ex. 1. Let the fluxion be $\frac{a\dot{y}+2x\dot{x}+y\dot{x}+x\dot{y}}{2\sqrt{(ay+x^2+xy)}}$, this expression when reduced to the form $\dot{u}=M\dot{x}+N\dot{y}$ is

$$\dot{u}=\frac{(2x+y)\dot{x}}{2\sqrt{(ay+x^2+xy)}}+\frac{(a+x)\dot{y}}{2\sqrt{(ay+x^2+xy)}}$$

hence $M=\frac{2x+y}{2\sqrt{(ay+x^2+xy)}}$, $N=\frac{a+x}{2\sqrt{(ay+x^2+xy)}}$, Inverse Method.

the fluxion of M, supposing y only variable, gives us

$$\dot{M}=M'\dot{y}=\frac{(ay+xy-2ax)\dot{y}}{4(ay+x^2+xy)^{\frac{3}{2}}},$$

and in like manner the fluxion of N, supposing x only variable, gives

$$\dot{N}=N'\dot{x}=\frac{(ay+xy-2ax)\dot{x}}{4(ay+x^2+xy)^{\frac{3}{2}}},$$

hence it appears that $M'=N'$, and therefore that the proposed expression is an exact fluxion. To determine its fluent, the formula $u=\int M\dot{x}+Y$ gives us

$$u=\sqrt{(ay+x^2+xy)}+Y$$

the fluxion of this expression taken, upon the supposition that both x and y are variable, is

$$\dot{u}=\frac{a\dot{y}+2x\dot{x}+y\dot{x}+x\dot{y}}{2\sqrt{(ay+x^2+xy)}}+\dot{Y}$$

this result, compared with the original fluxion, shews that $\dot{Y}=0$, and $Y=c$, a constant quantity.

Ex. 2. Suppose the fluxion to be

$$\dot{x}\sqrt{(a^2+y^2)}+\dot{y}\frac{(a^2+xy+2y^2)}{\sqrt{(a^2+y^2)}}$$

Here $M=\sqrt{(a^2+y^2)}$, $N=\frac{a^2+xy+2y^2}{\sqrt{(a^2+y^2)}}$, and by proceeding, as in last example, we shall find $M'=N'=\frac{y}{\sqrt{(a^2+y^2)}}$, hence it follows that the expression is a complete fluxion, and the formula $\dot{u}=\int M\dot{x}+Y$ shews that $u=\int\dot{x}\sqrt{(a^2+y^2)}+Y$

$$=x\sqrt{(a^2+y^2)}+Y.$$

To determine Y, we take the fluxion of this expression, supposing x and y both variable, and find it to be

$$\dot{u}=\dot{x}\sqrt{(a^2+y^2)}+\frac{xy\dot{y}}{\sqrt{(a^2+y^2)}}+\dot{Y},$$

and this compared with the original fluxion

$$\dot{u}=\dot{x}\sqrt{(a^2+y^2)}+\frac{(a^2+xy+2y^2)\dot{y}}{\sqrt{(a^2+y^2)}},$$

shews that $\dot{Y}=\frac{(a^2+2y^2)\dot{y}}{\sqrt{(a^2+y^2)}}$, hence

$$Y=\int\frac{(a^2+2y^2)\dot{y}}{\sqrt{(a^2+y^2)}}=y\sqrt{(a^2+y^2)}$$

therefore the fluent required is

$u=$

$$z=x\sqrt{(a^2+y^2)}+y\sqrt{(a^2+y^2)}+C$$
$$=(x+y)\sqrt{(a^2+y^2)}+C,$$

where C denotes a conſtant quantity.

190. It may be demonſtrated, that as often as a fluxional equation does not conſtitute a complete fluxion, there is always an infinite number of factors, ſuch, that if the equation were multiplied by any one of them, the reſult would be a complete fluxion. A general method of determining ſome one of theſe factors, however, ſeems to be a problem of ſuch difficulty, that its ſolution, except in ſome particular caſes, is not to be expected.

191. When a fluxional equation involves the ſecond or higher powers of $\dot{x}$ and $\dot{y}$, as in this example

$$\dot{y}^2-a^2\dot{x}^2=0,$$

which may be put under this form,

$$\frac{\dot{y}^2}{\dot{x}^2}-a^2=0,$$

we may, by the theory of algebraic equations, deduce from it the values of $\frac{\dot{y}}{\dot{x}}$, conſidering this quantity as a root of the equation; thus, in the preſent example, by reſolving the quadratic equation $\frac{\dot{y}^2}{\dot{x}^2}-a^2=0$, we have $\frac{\dot{y}}{\dot{x}}=\pm a$, ſo that $\dot{y}-a\dot{x}=0$, and $\dot{y}+a\dot{x}=0$, hence

$$y-ax+c=0, \quad y+ax+c'=0,$$

are two primitive equations, from either of which the fluxional equation $\dot{y}^2-a^2\dot{x}^2=0$ may be derived, and it may alſo be deduced from their product

$$(y-ax+c)(y+ax+c')=0.$$

192. As often as the equation contains only one of the two variable quantities, for example x, by the reſolution of the equation we may obtain $\frac{\dot{y}}{\dot{x}}=X$ (where X denotes ſome function of x), and hence $y=\int X\dot{x}$, but if it be more eaſy to reſolve the equation with reſpect to x than to $\frac{\dot{y}}{\dot{x}}$ which we ſhall denote by p, then, inſtead of ſeeking the values of p from the equation, we may find that of x, thus we ſhall have $x=P$, ſome function of p, and hence $\dot{x}=\dot{P}$, and ſince $\dot{y}=p\dot{x}$, therefore, $\dot{y}=p\dot{P}$, and $y=\int p\dot{P}=Pp-\int P\dot{p}$. The relation between x and y is now to be found by eliminating p by means of the two equations

$$x=P, \quad y=Pp-\int P\dot{p}.$$

As a particular example, let us ſuppoſe the equation to be $x\dot{x}+a\dot{y}=b\sqrt{(\dot{x}^2+\dot{y}^2)}$, from which, by putting $\frac{\dot{y}}{\dot{x}}=p$ we find

$$x=b\sqrt{(1+p^2)}-ap=P,$$

$$y=bp\sqrt{(1+p^2)}-\tfrac{1}{2}ap^2-b\int\dot{p}\sqrt{(1+p^2)}$$

the fluent of $\dot{p}\sqrt{(1+p^2)}$ may be found by the formulas given in § 130 and § 131.

193. When we cannot by any means find an expreſſion for the relation between x and y in finite terms, then we muſt, as a laſt reſource, have recourſe to approximation, that is, we muſt expreſs the value of y in terms of x by means of a ſeries.

When the form of the ſeries is known, we may determine the coefficients of its terms, by ſubſtituting the ſeries and its fluxion inſtead of y and $\dot{y}$ in the propoſed equation.

Suppoſe, for example, that the equation is

$$\dot{y}+y\dot{x}-mx^n\dot{x}=0$$

we may aſſume

$$y=Ax^\alpha+Bx^{\alpha+1}+Cx^{\alpha+2}+\&c.$$

then $\dot{y}=\alpha Ax^{\alpha-1}\dot{x}+(\alpha+1)Bx^\alpha\dot{x}$
$$+(\alpha+2)Cx^{\alpha+1}\dot{x}+\&c.$$

Subſtituting now the values of y and $\dot{y}$ in the equation, and dividing the whole by $\dot{x}$, it becomes

$$\left.\begin{matrix}\alpha A x^{\alpha-1}+(\alpha+1)B\\ -mx^n+\quad A\end{matrix}\right\}x^\alpha+\left.\begin{matrix}(\alpha+2)C\\ +\quad B\end{matrix}\right\}x^{\alpha+1}$$
$$+\left.\begin{matrix}(\alpha+3)D\\ +\quad C\end{matrix}\right\}x^{\alpha+2}+\&c.=0.$$

This equation becomes identical, if we aſſume $\alpha-1=n$, or $\alpha=n+1$, and

$$A=\frac{m}{\alpha}, \quad B=\frac{-m}{\alpha(\alpha+1)}, \quad C=\frac{m}{\alpha(\alpha+1)(\alpha+2)},$$

$$D=\frac{-m}{\alpha(\alpha+1)(\alpha+2)(\alpha+3)}, \&c.$$

Hence we have

$$y=m\left\{\frac{x^{n+1}}{n+1}-\frac{x^{n+2}}{(n+1)(n+2)}\right.$$
$$\left.+\frac{x^{n+3}}{(n+1)(n+2)(n+3)}-\&c.\right\}$$

In order that a primitive equation may be general, it ought to contain an indeterminate conſtant quantity more than is found in the fluxional equation, therefore, this ſeries which contains no ſuch quantity, muſt be conſidered as incomplete, or as exhibiting the value of y upon the ſuppoſition, that, when $x=0$, then $y=0$. However, we may obtain a value of y that ſhall be general,

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neral, by proceeding as follows. Let us ſuppoſe we know that when $x=a$, then $y=b$; aſſume $x=a+t$, and $y=b+u$, then it is manifeſt, that, if the value of u be found by a ſeries involving t, all the terms of the ſeries ought to vaniſh when $t=0$. From the aſſumed values of x and y the equation

$$\dot{y}+y\dot{x}-mx^{n}\dot{x}=0$$

becomes

$$\dot{u}+(b+u)\dot{t}-m(a+t)^{n}\dot{t}=0.$$

Aſſume now

$$u=At^{\alpha}+Bt^{\alpha+1}+Ct^{\alpha+2}+\&c.$$

then, proceeding as before, we find

$$\left.\begin{array}{l} *\ A t^{\alpha-1}+(\alpha+1)B t^{\alpha}+(\alpha+2)C t^{\alpha+1}+\&c. \\ \qquad + \quad A t^{\alpha}+ \quad B t^{\alpha+1}+\&c. \\ +b \\ -m a^{n}-m_{1}^{n} a^{n-1} t-m\frac{n(n-1)}{1\cdot 2} a^{n-2}t^{2}-\&c. \end{array}\right\}=0.$$

It is neceſſary, in this equation, to aſſume $\alpha-1=0$, or $\alpha=1$, and hence we find

$$A=ma^{n}-b, \quad B=\frac{mna^{n-1}-ma^{n}+b}{2},$$

$$C=\frac{mn(n-1)a^{n-2}-mna^{n-1}+ma^{n}-b}{2\cdot 3},$$

&c.

If we now ſubſtitute $x-a$, and $y-b$ for t and u reſpectively, the reſult will have all the generality that belongs to a primitive equation, expreſſing the relation between x and y.

Of Fluxional Equations of the ſecond or higher orders.

194. Whatever difficulties occur in finding the primitive equation of a fluxional equation of the firſt order, it will eaſily be conceived, that theſe difficulties muſt be greater and more numerous when we have to conſider fluxional equations of the ſecond and higher orders.

One of the moſt ſimple caſes of an equation of the ſecond order is this

$$\ddot{y}-X\dot{x}^{2}=0, \text{ or } \frac{\ddot{y}}{\dot{x}^{2}}=X,$$

where X denotes a function of x, the variable quantity whoſe fluxion is ſuppoſed to be conſtant; in this caſe, becauſe $\frac{\ddot{y}}{\dot{x}}=X\dot{x}$, we have $\frac{\dot{y}}{\dot{x}}=\int X\dot{x}$. Let P denote that function of which $X\dot{x}$ is the fluxion, and c, as uſual, an indeterminate conſtant quantity, then $\frac{\dot{y}}{\dot{x}}=P+c$, and $\dot{y}=P\dot{x}+c\dot{x}$, and taking the fluents a ſecond time

Inverſe Method.

$$y=\int P\dot{x}+cx+c'$$

where c' denotes a ſecond indeterminate conſtant quantity.

$$As \int P\dot{x}=Px-\int \dot{P}x=x\int X\dot{x}-\int Xx\dot{x}$$

we have alſo

$$y=x\int X\dot{x}-\int Xx\dot{x}+cx+c'.$$

Suppoſe, for example, that the equation is $\ddot{y}-ax\dot{x}^{2}=0$, ſo that $\frac{\ddot{y}}{\dot{x}^{2}}=ax$; here $X=ax$, and therefore

$$y=x\int ax\dot{x}-\int ax^{2}\dot{x}+cx+c'$$

$$=\tfrac{1}{2}ax^{3}-\tfrac{1}{3}ax^{3}+cx+c'$$

$$=\tfrac{1}{6}ax^{3}+cx+c'.$$

In the very ſame manner we may deduce from the equation of the third order

$$\dddot{y}-X\ddot{x}^{3}=0, \text{ or } \frac{\dddot{y}}{\dot{x}^{3}}=X$$

its primitive equation; thus we have

$$\frac{\dddot{y}}{\dot{x}^{2}}=X\dot{x}, \quad \frac{\ddot{y}}{\dot{x}^{2}}=\int X\dot{x}=P+c,$$

where P denotes ſuch a function of x, that its fluxion is $X\dot{x}$, and c repreſents a conſtant quantity. Again

$$\frac{\ddot{y}}{\dot{x}}=P\dot{x}+c\dot{x},$$

$$\frac{\dot{y}}{\dot{x}}=\int P\dot{x}+cx+c'=Q+cx+c';$$

here Q is put for $\int P\dot{x}$, and c' for a ſecond conſtant quantity. In like manner we have

$$\dot{y}=Q\dot{x}+cx\dot{x}+c'\dot{x},$$

$$\text{and } y=\int Q\dot{x}+\tfrac{1}{2}cx^{2}+c'x+c'';$$

and as P and Q are functions of x, the fluents of $P\dot{x}$ and $Q\dot{x}$ may be found by the methods formerly explained.

195. Let us next conſider ſuch equations as involve only $\frac{\ddot{y}}{\dot{x}^{2}}$, $\frac{\dot{y}}{\dot{x}}$ and conſtant quantities. In order to abridge let us put $\frac{\dot{y}}{\dot{x}}=p$, then ſuch an equation may be generally expreſſed thus $\frac{\ddot{y}}{\dot{x}^{2}}=P$, where P denotes ſome known

Inverse Method.

known function of p; now as $\frac{\dot{y}}{\dot{x}} = p$, by taking the fluxions, and obſerving that $\dot{x}$ is conſtant, we have $\frac{\ddot{y}}{\dot{x}^2} = \frac{\dot{p}}{\dot{x}}$, hence $\frac{\dot{p}}{\dot{x}} = \mathrm{P}$, and $\dot{x} = \frac{\dot{p}}{\mathrm{P}}$, and $x = \int \frac{\dot{p}}{\mathrm{P}}$; let the value of $\dot{x}$ be ſubſtituted inſtead of it in the equation $\dot{y} = p\dot{x}$, and it becomes $\dot{y} = \frac{p\dot{p}}{\mathrm{P}}$ and hence $y = \int \frac{p\dot{p}}{\mathrm{P}}$; thus it appears that if we can find the fluents $\int \frac{\dot{p}}{\mathrm{P}}$ and $\int \frac{p\dot{p}}{\mathrm{P}}$ we ſhall have the primitive equation when we eliminate p by means of theſe two equations

$$x = c + \int \frac{\dot{p}}{\mathrm{P}}, \quad y = c' + \int \frac{p\dot{p}}{\mathrm{P}},$$

where c and c' denote the two indeterminate conſtant quantities that ought to enter into the primitive equation.

Suppoſe for example that the equation is

$$\frac{(\dot{x}^2 + \dot{y}^2)^{\frac{3}{2}}}{-\dot{x}\,\ddot{y}} = a$$

which, by putting p for $\frac{\dot{y}}{\dot{x}}$, and $\frac{\dot{p}}{\dot{x}}$ for $\frac{\ddot{y}}{\dot{x}^2}$ becomes transformed to

$$-\frac{(1+p^2)^{\frac{3}{2}}\dot{x}}{\dot{p}} = a;$$

hence we have

$$\dot{x} = \frac{-a\dot{p}}{(1+p^2)^{\frac{1}{2}}}, \qquad \dot{y} = p\dot{x} = \frac{-ap\dot{p}}{(1+p^2)^{\frac{1}{2}}},$$

$$x = c - \frac{ap}{\sqrt{(1+p^2)}}, \qquad y = c' + \frac{a}{\sqrt{(1+p^2)}};$$

when by means of theſe equations we eliminate p we obtain $(x-c)^2 + (y-c')^2 = a^2$.

The fluxional equation is evidently formed by putting the general expreſſion for the radius of curvature (given in § 97.) equal to a conſtant quantity, and the primitive equation is accordingly an equation to a circle having that conſtant quantity for its radius, as it ought to be.

196. Suppoſe now that the equation has this form

$$\frac{\ddot{y}}{\dot{x}^2} = \mathrm{Y},$$

where Y denotes a function of y, then putting as before $\frac{\dot{y}}{\dot{x}} = p$, we have $\frac{\ddot{y}}{\dot{x}^2} = \frac{\dot{p}}{\dot{x}} = \frac{p\dot{p}}{\dot{y}}$, hence the equation $\frac{\ddot{y}}{\dot{x}^2} = \mathrm{Y}$ becomes $\frac{p\dot{p}}{\dot{y}} = \mathrm{Y}$, and $p\dot{p} = \mathrm{Y}\dot{y}$, and $p^2 = 2\int \mathrm{Y}\dot{y} + c$, hence $p = \frac{\dot{y}}{\dot{x}} = \sqrt{(c + 2\int \mathrm{Y}\dot{y})}$ and Inverse Method.

$$x = \int \frac{\dot{y}}{\sqrt{(c + 2\int \mathrm{Y}\dot{y})}} + c'$$

where c and c' denote two conſtant quantities.

To take a particular example let us ſuppoſe the equation to be $\ddot{y} - y\dot{x}^2 = a\dot{x}^2$, or $\frac{\ddot{y}}{\dot{x}^2} = a + y$, here $\mathrm{Y} = a + y$, and $2\int \mathrm{Y}\dot{y} = 2ay + y^2$, hence (and by § 127.),

$$x = \int \frac{\dot{y}}{\sqrt{(c + 2ay + y^2)}} + c'$$
$$= \mathrm{l.}\left\{a + x + \sqrt{(a + 2ay + y^2)}\right\} + c'.$$

197. When the equation contains $\frac{\dot{y}}{\dot{x}}$, $\frac{\ddot{y}}{\dot{x}^2}$ and x, it may be transformed to a fluxional equation of the firſt order by ſubſtituting in it $p\dot{x}$, and $\dot{p}\dot{x}$ inſtead of $\dot{y}$, and $\ddot{y}$; if we can find the primitive of that fluxional equation, and thence the value of p in terms of x, we ſhall have the value of y from the formula $y = \int p\dot{x}$, or if we have the value of x in terms of p, then, becauſe $\int p\dot{x} = px - \int \dot{x}p$, we ſhall have

$$y = px - \int \dot{x}\dot{p}.$$

Suppoſe the equation to be

$$\frac{(\dot{x}^2 + \dot{y}^2)^{\frac{3}{2}}}{-\dot{x}\,\ddot{y}} = \mathrm{X}, \text{ or } -\frac{(1+p^2)^{\frac{3}{2}}\dot{x}}{\dot{p}} = \mathrm{X},$$

where X denotes any function of x, then,

$$\frac{\dot{x}}{\mathrm{X}} = \frac{-\dot{p}}{(1+p^2)^{\frac{3}{2}}}, \text{ and } \int \frac{\dot{x}}{\mathrm{X}} = \frac{-p}{\sqrt{(1+p^2)}};$$

Let us repreſent $\int \frac{\dot{x}}{\mathrm{X}}$ by V, then $p = \frac{\mathrm{V}}{\sqrt{(1-\mathrm{V}^2)}}$, and

$$y = \int p\dot{x} = \int \frac{\mathrm{V}\dot{x}}{\sqrt{(1-\mathrm{V}^2)}}.$$

This equation evidently expreſſes the nature of a curve ſuch, that $\frac{(\dot{x}^2 + \dot{y}^2)^{\frac{3}{2}}}{-\dot{x}\,\ddot{y}}$, its radius of curvature (§ 97.), is equal to X a function of x one of its coordinates.

198. If the propoſed fluxional equation of the ſecond order contains $\frac{\dot{y}}{\dot{x}}$, $\frac{\ddot{y}}{\dot{x}^2}$ and y, to transform it we muſt exterminate $\dot{x}$ by means of its value $\frac{\dot{y}}{p}$ deduced from the equation $\dot{y} = p\dot{x}$, thus we ſhall have

$\frac{\ddot{y}}{\dot{x}^2}$

$$\frac{\ddot{y}}{\dot{x}^2}=\frac{\dot{p}}{\dot{x}}=\frac{p\,\dot{p}}{\dot{y}}$$

and the reſult will be an equation of the firſt order containing only p, $\dot{p}$ and $\dot{y}$; when its primitive equation can be found, and thence the value of p in terms of y, we may find x by the formula $x=\int\frac{\dot{y}}{p}$, and by the formula $x=\frac{y}{p}+\int\frac{y\dot{p}}{p^2}$ when y is expreſſed by means of p.

199. As an example of the manner in which fluxional equations of the ſecond order are to be reſolved by approximation, we ſhall take the particular equation

$$\ddot{y}+a\,x^n y\,\dot{x}^2=0.$$

If the value of y which ſatisfies the equation be ſuppoſed to have this form

$$Ax^\alpha+Bx^{\alpha+\delta}+Cx^{\alpha+2\delta}+\&c.$$

and that the ſeries of exponents goes on increaſing, or that δ is poſitive, we may, by ſuppoſing x to be a very ſmall quantity, conceive that the expreſſion for y is reduced to its firſt term, becauſe in that caſe each of the following terms will be inconſiderable in reſpect of that term. According to this hypotheſis we ſhall have

$$y=Ax^\alpha,\ \ddot{y}=\alpha(\alpha-1)Ax^{\alpha-2}\,\dot{x}^2$$

and thus the propoſed equation becomes

$$\alpha(\alpha-1)A\,x^{\alpha-2}+a\,A\,x^{\alpha+n}=0.$$

It will not be poſſible to give to α ſuch a value that the two exponents $\alpha-2$ and $\alpha+n$ ſhall become equal, except in the particular caſe of $n=-2$; but if we ſuppoſe x very ſmall the equation may be ſatisfied in two ways, namely, by taking $\alpha=0$, and $\alpha=1$, becauſe upon either ſuppoſition the term $\alpha(\alpha-1)Ax^{\alpha-2}$, which is the greateſt, vaniſhes, and therefore A is left indeterminate; thus we have two ſeries, one beginning with A, and the other with Ax.

Aſſuming therefore ſucceſſively

$$y=A+Bx^\delta+Cx^{2\delta}+\&c.$$

$$y=Ax+Bx^{1+\delta}+Cx^{1+2\delta}+\&c.$$

and ſubſtituting theſe values as well as their correſponding values of $\dot{y}$ in the propoſed equation, we ſhall find by arranging the terms, that δ ought to be $=2$; afterwards by determining the coefficients A, B, C, &c. in the uſual manner (ALGEBRA, § 261.) we obtain two ſeries, one of theſe is

$$A-\frac{aAx^{n+2}}{(n+1)(n+2)}+\frac{a^2Ax^{2n+4}}{(n+1)(n+2)(2n+3)(2n+4)}-\frac{a^3Ax^{3n+6}}{(n+1)(n+2)(2n+3)(2n+4)(3n+5)(3n+6)}+\&c.$$

and the other

$$Ax-\frac{aAx^{n+3}}{(n+2)(n+3)}+\frac{a^2Ax^{2n+5}}{(n+2)(n+3)(2n+4)(2n+5)}-\frac{a^3Ax^{3n+7}}{(n+2)(n+3)(2n+4)(2n+5)(3n+6)(3n+7)}+\&c.$$

As a primitive equation in its general form ought to contain two conſtant quantities which do not appear in the fluxional equation of the ſecond order derived from it (§ 177.), the value of y to be complete ought to contain two arbitrary conſtant quantities, but as each of theſe ſeries contains only one ſuch quantity, namely A, it muſt be conſidered as expreſſing only a particular value of y. The fluxional equation $\ddot{y}+a\,x^n y\,\dot{x}^2=0$ is however of ſuch a nature that from two particular values of y we may deduce its general value; for let us denote theſe values by z and Z, then, as each of them muſt ſatisfy the fluxional equation, we have

$$\ddot{z}+a\,x^n z\,\dot{x}^2=0,\ \ddot{Z}+a\,x^n Z\,\dot{x}^2=0;$$

let c and C denote two arbitrary conſtant quantities, then we have alſo

$$c\ddot{z}+c\,a\,x^n z\,\dot{x}^2=0,\ C\ddot{Z}+C\,a\,x^n Z\dot{x}^2=0,$$

and as each of theſe equations is identical, their ſum muſt alſo be identical, that is

$$c\ddot{z}+C\ddot{Z}+a\,x^n(cz+CZ)\dot{x}^2=0;$$

but the very ſame reſult will be obtained if we ſubſtitute $cz+CZ$ inſtead of y in the propoſed fluxional equation, therefore $cz+CZ$ is alſo a value of y, and as it involves two arbitrary conſtant quantities c and C, it poſſeſſes all the generality of which the value of y is ſuſceptible. Hence it follows that that if c be put inſtead of A in one of the two ſeries which we have found for the value of y, and C inſtead of A in the other ſeries, the ſum of the two reſults will be a general expreſſion for the value of y.

200. Having now explained the theory of fluxional equations at as great length as we conceive to be compatible with the nature of this work we ſhall conclude this treatiſe by reſolving a few problems which produce fluxional equations.

Prob. 1. Having given any *hyperbolic*, or as it may more properly be called *Napierean* logarithm, it is required to find a general expreſſion for its correſponding natural number.

Let the number be denoted by $1+x$, and its logarithm by y, then $\dot{y}=\frac{\dot{x}}{1+x}$ (§ 57.), or

$$\dot{y}+x\,\dot{y}-\dot{x}=0,$$

and the problem requires that from this equation we deduce an expreſſion for x.

As when $y=0$, then $x=0$, we may aſſume

$$x=Ay+By^2+Cy^3+\&c.$$

then $\dot{x}=A\dot{y}+2By\,\dot{y}+3Cy^2\dot{y}+\&c.$

and our equation becomes

Inverse Method.

$$\left.\begin{array}{l}\dot{y}+A\dot{y}\dot{y}+B\dot{y}^2\dot{y}+C\dot{y}^3\dot{y}+\text{ \&c.}\\ -A\dot{y}-2By\dot{y}-3Cy^2\dot{y}-4Dy^3\dot{y}-\text{\&c.}\end{array}\right\}=0.$$

Hence, by comparing the coefficients of the like terms it appears that $A=1$, $2B=A$, $3C=B$, $4D=C$, &c. fo that $A=1$, $B=\frac{1}{2}$, $C=\frac{1}{2.3}$, $D=\frac{1}{2.3.4}$, &c.

therefore $x=y+\frac{y^2}{2}+\frac{y^3}{2.3}+\frac{y^4}{2.3.4}+$ &c. and

$$1+x=1+y+\frac{y^2}{2}+\frac{y^3}{2.3}+\frac{y^4}{2.3.4}+\text{ \&c.}$$

Fig. 38. *Prob.* 2. Let AB, AC be two ſtraight lines given by poſition meeting each other at right angles in A, let C be a given point in AC one of the lines, and let a ſtraight line PQ meet them in P and Q, and cut off from them equal ſegments AP, CQ adjacent to the given points A,C, it is required to find the nature of the curve to which PQ is a tangent.

Let D be the point in which the tangent PQ meets the curve, draw DE perpendicular to AC, and DF to AP, put $CA=a$, $CE=x$ $ED=y$, then AE or DF $=a-x$, and ſince $EQ=\frac{\dot{y}x}{\dot{y}}$ (§ 73.) and $EQ:ED::$ DF : FP, therefore $FP=\frac{(a-x)\dot{y}}{\dot{x}}$; hence $PA=$ $(PF+FA=)\frac{(a-x)\dot{y}}{\dot{x}}+y$, and $CQ=(CE-EQ=)$ $x-\frac{\dot{y}x}{\dot{y}}$, and as by hypotheſis AP=CQ, therefore

$$y+\frac{(a-x)\dot{y}}{\dot{x}}=x-\frac{\dot{y}\dot{x}}{\dot{y}}$$

This expreſſion belongs to a claſs of fluxional equations which have the ſingular property of being more eaſily reſolved by firſt taking their fluxion, conſidering the fluxion of one of the variable quantities as conſtant; thus, in the preſent caſe, making $\dot{x}$ conſtant, we find

$$\dot{y}\frac{\dot{x}\dot{y}-(a-x)\ddot{y}}{\dot{x}}=\dot{x}-\frac{\dot{x}\dot{y}^2-y\dot{x}\ddot{y}}{\dot{y}^2}.$$

$$\text{or }\frac{(a-x)\ddot{y}}{\dot{x}}=\frac{y\dot{x}\ddot{y}}{\dot{y}^2}$$

hence dividing by $\ddot{y}$, the equation is eaſily reduced to

$$\frac{\dot{y}}{\sqrt{y}}=\frac{\dot{x}}{\sqrt{(a-x)}}$$

and taking the fluents

$$\sqrt{y}=c-\sqrt{(a-x)}$$

but when $x=0$, then $y=0$, therefore $c=\sqrt{a}$, and

$$\sqrt{y}=\sqrt{a}-\sqrt{(a-x)}, \text{ or } x=2\sqrt{ay}-y,$$

which equation belongs to the common parabola.

Fig. 39. *Prob.* 3. Let APQ be one of any number of curves of the parabolic kind, having the ſame vertex A, and axis AE, and the nature of which is defined by the equation $px^m=y^n$, where x denotes the abſciſſa AB, and y the ordinate PB, and p an indeterminate quantity which is the ſame for the whole of any one of the parabolas, but different for different parabolas; it is required to find the nature of a curve that ſhall interſect them all in a given angle. Inverſe Method.

Let the curve whoſe nature is required meet any one of the parabolas in P, let PT, P t tangents to the two curves meet the axis in T and t, then, from the nature of the problem, the lines PT, P t muſt contain a given angle, let a denote its numerical tangent.

Becauſe PT touches the parabola, the tangent of the angle PTB will be equal to $\frac{\dot{y}}{\dot{x}}$ (§ 75.) the value of this expreſſion being ſuppoſed deduced from the equation $px^m=y^n$; but taking the fluxion of this equation, and eliminating the indeterminate quantity p by means of the two equations, we find $\frac{\dot{y}}{\dot{x}}=\frac{my}{nx}$, therefore tan. $T=\frac{my}{nx}$.

Again, by conſidering x and y as the abſciſſa and ordinate of the curve whoſe equation is ſought, and to which P t is a tangent, we have the tangent of the angle t equal to $\frac{\dot{y}}{\dot{x}}$ (§ 75.). Now the angle TP t being the difference of the two angles PTB, P t B it follows from the formula for finding the tangent of the difference of two angles, (ALGEBRA, § 368.) that

$$a=\frac{\frac{\dot{y}}{\dot{x}}-\frac{my}{nx}}{1+\frac{my\dot{y}}{nx\dot{x}}},$$

hence we have

$$a(nx\dot{x}+my\dot{y})+my\dot{x}-nx\dot{y}=0,$$

a fluxional equation expreſſing the nature of the curve, which being homogeneous may be treated according to the method explained in § 180.

If the curves be ſuppoſed to cut each other at right angles, then, a being infinite, the part of the equation which is not multiplied by a vaniſhes in reſpect of the other, which is multiplied by it; hence we have

$$nx\dot{x}+my\dot{y}=0$$

and taking the fluents

$$nx^2+my^2=c$$

where c is put for a conſtant quantity. This equation ſhews that the curve is an ellipſe the centre of which is at A the common vertex of all the parabolas.

The problem which we have here reſolved is only a particular caſe of one more general, and which has for its object *To determine the nature of the curve which interſects all other curves of a given kind in a given angle.* The problem thus generaliſed is known by the name of the *Problem of Trajectories*; it was originally propoſed by *Leibnitz* as a challenge to the Engliſh mathematicians, and reſolved by *Newton*, on the day he received it.

FLY,

Fig. 1.

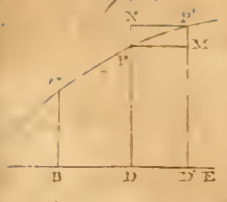


Fig. 2.

Fig. 3.

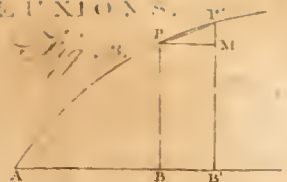


Fig. 4.

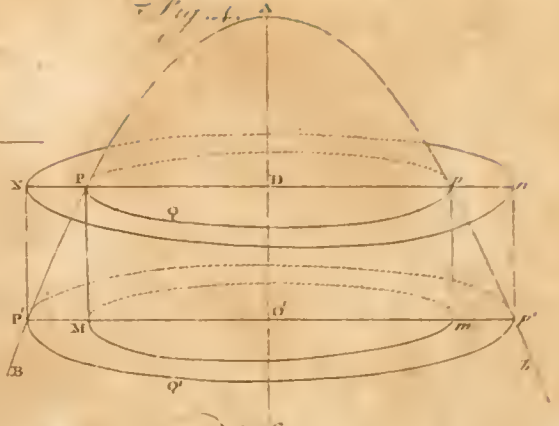


Fig. 5.

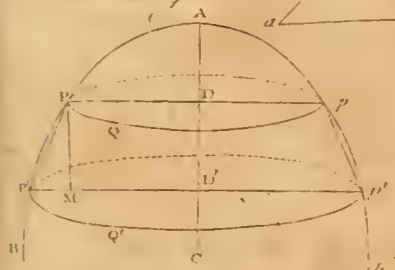


Fig. 6.

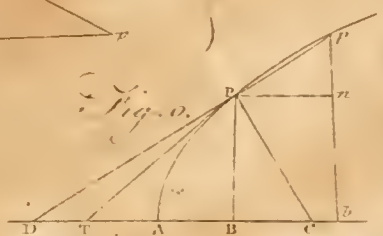


Fig. 7.

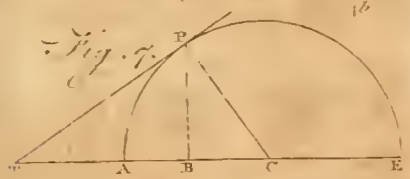


Fig. 8.

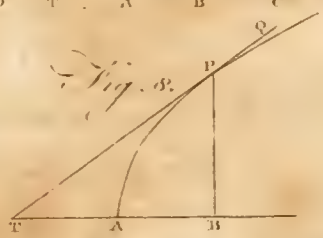
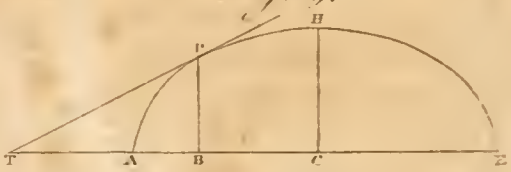


Fig. 9.



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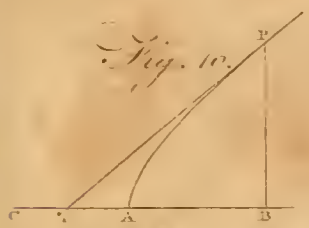

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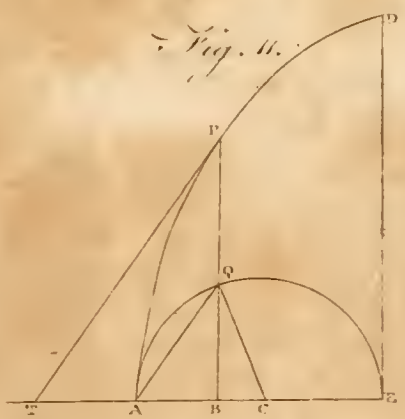

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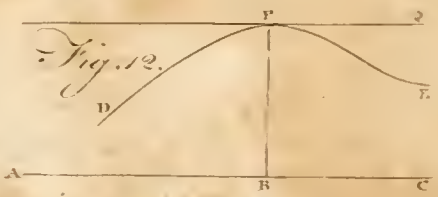

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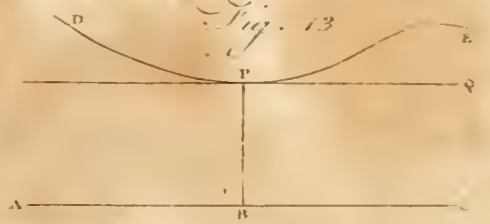

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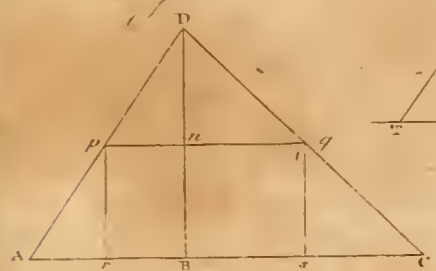

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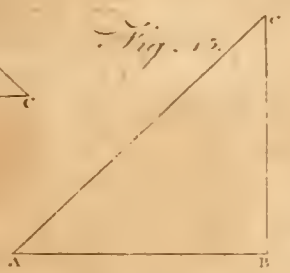

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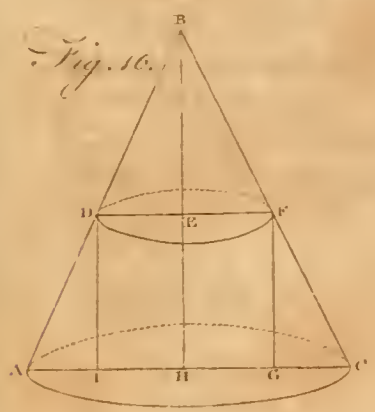

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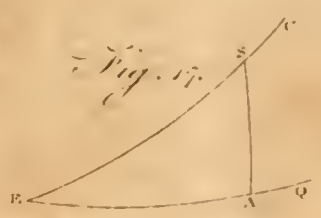

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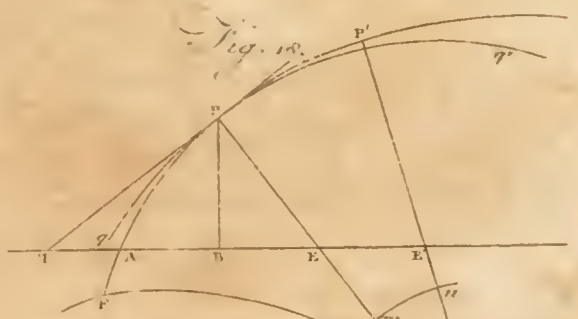

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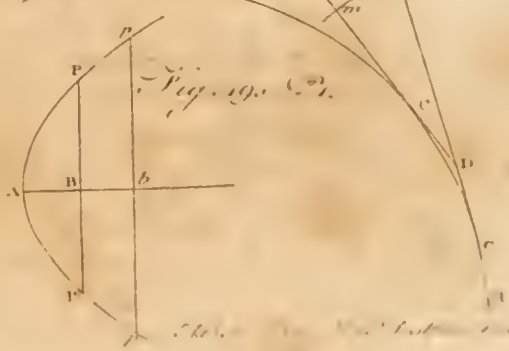

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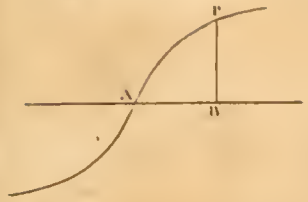

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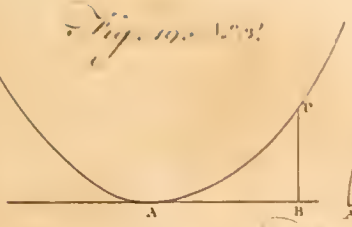

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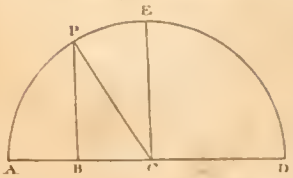

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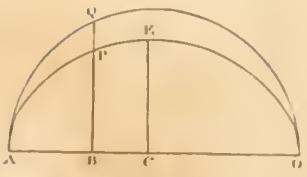

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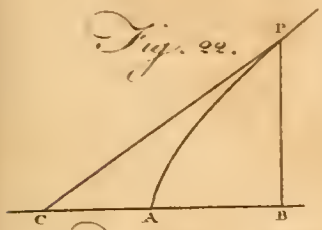

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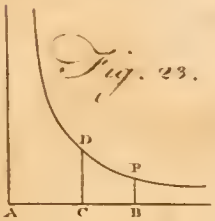

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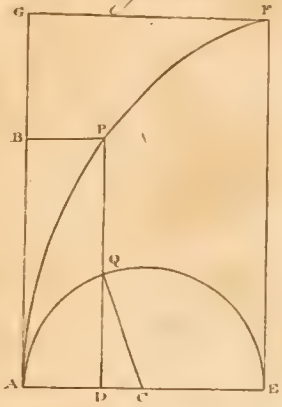

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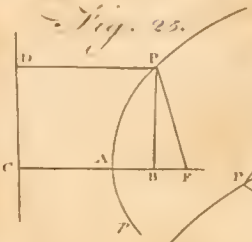

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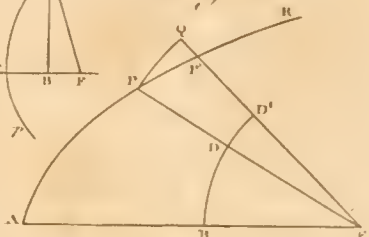

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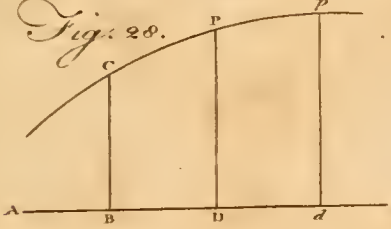

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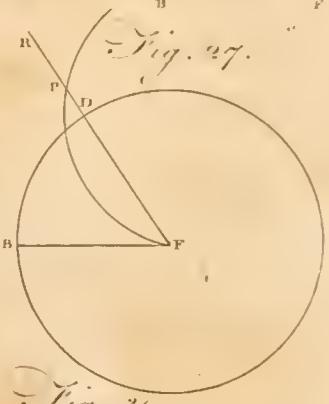

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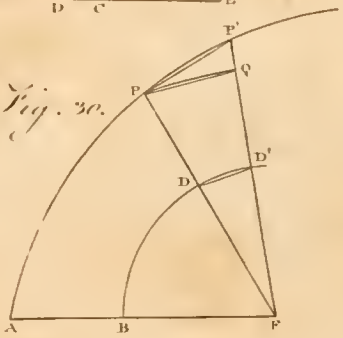

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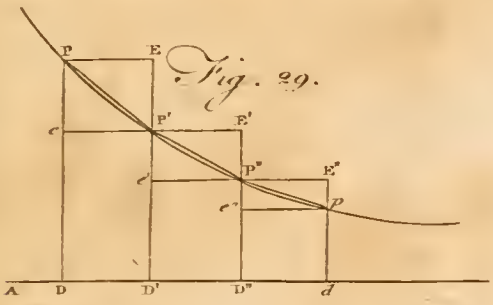

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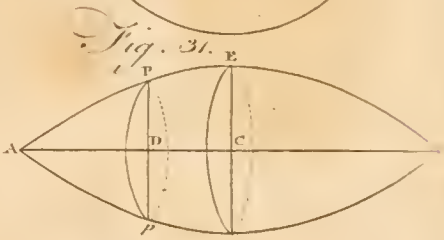

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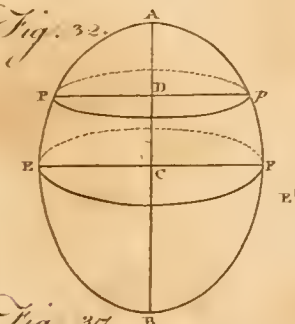

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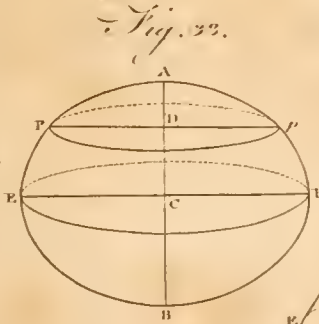

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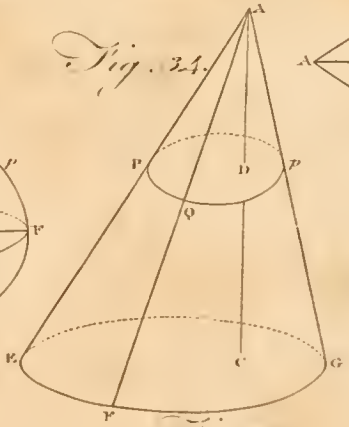

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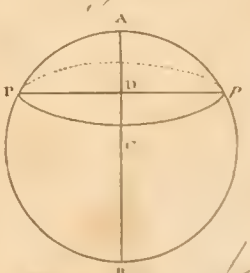

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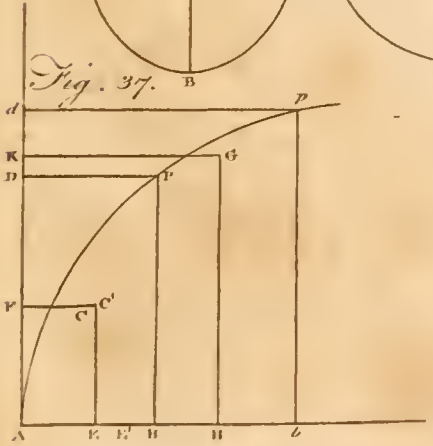

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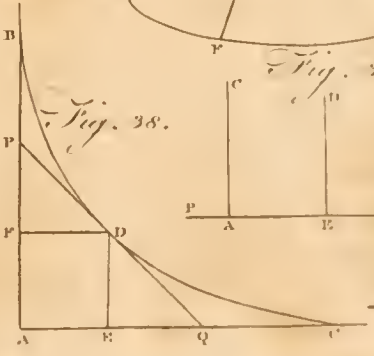

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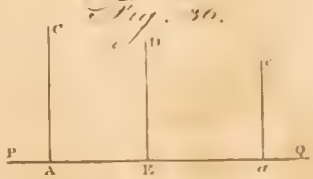

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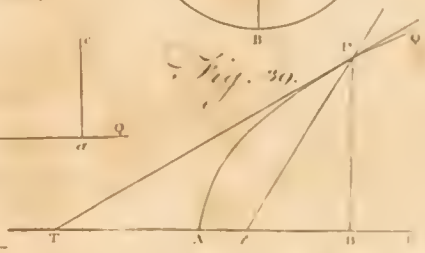

Fly
||
Fly-tree.

FLY, in *Zoology*, a large order of inſects, the diſtinguiſhing characteriſtic of which is, that their wings are tranſparent. By this they are diſtinguiſhed from beetles, butterflies, graſhoppers, &c. Flies are ſubdivided into thoſe which have four, and thoſe which have two wings. Of thoſe with four wings there are ſeveral genera or kinds; as the ant, the bee, the ichneumou, &c. Of thoſe with two wings, there are likewiſe ſeveral kinds, as the gad-fly, gnat, houſe-fly, &c. For their claſſification and natural hiſtory, ſee ENTOMOLOGY.

Houſe FLY. See MUSCA.

Peſtilential FLY. See ABYSSINIA.

FLY, in mechanics, a croſs with leaden weights at its ends; or rather, a heavy wheel at right angles to the axis of a windlaſs, jack, or the like; by means of which, the force of the power, whatever it is, is not only preſerved, but equally diſtributed in all parts of the revolution of the machine. See MECHANICS.

Flies for Fiſhing. See *Fishing Fly*.

Vegetable FLY, a curious natural production chiefly found in the Weſt Indies. "Excepting that it has no wings, it reſembles the drone both in ſize and colour more than any other Britiſh inſect. In the month of May it buries itſelf in the earth, and begins to vegetate. By the latter end of July, the tree is arrived at its full growth, and reſembles a coral branch; and is about three inches high, and bears ſeveral little pods, which dropping off become worms, and from thence flies, like the Britiſh caterpillar."

Phil. Tranſ. for 1763.

Such was the account originally given of this extraordinary production. But ſeveral boxes of theſe flies having been ſent to Dr Hill for examination, his report was this: "There is in Martinique a fungus of the clavaria kind, different in ſpecies from thoſe hitherto known. It produces ſoboles from its ſides; I call it therefore *clavaria ſobolifera*. It grows on putrid animal bodies, as our *fungus ex pede equino* from the dead horſe's hoof. The cicada is common in Martinique; and in its nympha ſtate, in which the old authors call it *tettigometra*, it buries itſelf under dead leaves to wait its change; and when the ſeaſon is unfavourable, many periſh. The ſeeds of the clavaria find a proper bed on this dead inſect, and grow. The tettigometra is among the cicadæ in the Britiſh muſeum; the clavaria is juſt now known. This is the fact, and all the fact; though the untaught inhabitants ſuppoſe a fly to vegetate, and though there is a Spaniſh drawing of the plant's growing into a trifoliate tree, and it has been figured with the creature flying with this tree upon its back." See Edwards' Gleanings of Natural Hiſtory.

Fly-Boat, or *Flight*, a large flat-bottomed Dutch veſſel, whoſe burden is generally from 600 to 1200 tons. It is diſtinguiſhed by a very high ſtern, reſembling a Gothic turret, and by very broad buttocks below.

Fly-Catcher, in *Zoology*. See MUSCICAPA.

Venus's Fly-Trap, a kind of ſenſitive plant. See *Dionæa Muſcipula*, BOTANY *Index*.

Fly-Tree, in *Natural Hiſtory*, a name given by the common people of America to a tree, whoſe leaves, they ſay, at a certain time of the year produce *flies*. On examining theſe leaves about the middle of ſummer, the time at which the flies uſe to be produced, there are found on them a ſort of bags of a tough matter, of about the ſize of a filbert, and of a duſky greeniſh colour. On opening one of theſe bags with a knife, there is uſually found a ſingle full grown fly, of the gnat kind, and a number of ſmall worms, which in a day or two more have wings and fly away in the form of their parent. The tree is of the mulberry kind, and its leaves are uſually very largely ſtocked with theſe inſect bags; and the generality of them are found to contain the inſects in their worm ſtate; when they become winged, they ſoon make their way out. The bags begin to appear when the leaves are young, and afterwards grow with them; but they never rumple the leaf or injure its ſhape. They are of the kind of leaf-galls, and partake in all reſpects, except ſize, of a ſpecies we have frequent on the large maple, or, as it is called, the *ſycamore*.

Flyers.

FLYERS, in architecture, ſuch ſtairs as go ſtraight, and do not wind round, or have the ſteps made tapering; but the fore and back part of each ſtair and the ends reſpectively parallel to one another: So that if one flight do not carry you to your deſigned height, there is a broad half ſpace; and then you fly again, with ſteps everywhere of the ſame breadth and length as before.

FLYERS, the performers in a celebrated exhibition among the Mexicans, which was made on certain great feſtivals, and is thus deſcribed by Clavigero in his Hiſtory of that people. "They fought in the woods for an extremely lofty tree, which, after ſtripping it of its branches and bark, they brought to the city, and fixed in the centre of ſome large ſquare. They caſed the point of the tree in a wooden cylinder, which, on account of ſome reſemblance in its ſhape, the Spaniards called a *mortar*. From this cylinder hung four ſtrong ropes, which ſerved to ſupport a ſquare frame. In the ſpace between the cylinder and the frame, they fixed four other thick ropes, which they twiſted as many times round the tree as there were revolutions to be made by the flyers. Theſe ropes were drawn through four holes, made in the middle of the four planks of which the frame conſiſted. The four principal flyers, diſguiſed like eagles, herons, and other birds, mounted the tree with great agility, by means of a rope which was laced about it from the ground up to the frame; from the frame they mounted one at a time ſucceſſively upon the cylinder, and after having danced there a little, they tied themſelves round with the ends of the ropes, which were drawn through the holes of the frame, and launching with a ſpring from it, began their flight with their wings expanded. The action of their bodies put the frame and the cylinder in motion; the frame by its revolutions gradually untwiſted the cords by which the flyers ſwung; ſo that as the ropes lengthened, they made ſo much the greater circles in their flight. Whilſt theſe four were flying, a fifth danced upon the cylinder, beating a little drum, or waving a flag, without the ſmalleſt apprehenſion of the danger he was in of being precipitated from ſuch a height. The others who were upon the frame (10 or 12 perſons generally mounted), as ſoon as they ſaw the flyers in their laſt revolution, precipitated themſelves by the ſame ropes, in order to reach the ground at the ſame time amidſt the acclamations of the populace. Thoſe who precipitated themſelves in this manner by the ropes, that they might make a ſtill greater diſplay of their

Flying. agility, frequently paſſed from one rope to another, at that part where, on account of the little diſtance between them, it was poſſible for them to do ſo. The moſt eſſential point of this performance conſiſted in proportioning ſo juſtly the height of the tree with the length of the ropes, that the flyers ſhould reach the ground with 13 revolutions, to repreſent by ſuch number their century of 52 years, compoſed in the manner we have already mentioned. This celebrated diverſion is ſtill in uſe in that kingdom; but no particular attention is paid to the number of the revolutions of the flyers; as the frame is commonly hexagonal or octagonal, and the flyers ſix or eight in number. In ſome places they put a rail round the frame, to prevent accidents, which were frequent after the conqueſt; as the Indians became much given to drinking, and uſed to mount the tree when intoxicated with wine or brandy, and were unable to keep their ſtation on ſo great a height, which was uſually 60 feet.

FLYING, the progreſſive motion of a bird, or other winged animal, in the air.

The parts of birds chiefly concerned in flying are the wings and tail; by the firſt, the bird ſuſtains and wafts himſelf along; and by the ſecond, he is aſſiſted, in aſcending and deſcending, to keep his body poiſed and upright, and to obviate the vacillations thereof.

It is by the ſize and ſtrength of the pectoral muſcles, that birds are ſo well diſpoſed for quick, ſtrong, and continued flying. Theſe muſcles, which in men are ſcarcely a 70th part of the muſcles of the body, in birds exceed and outweigh all the other muſcles taken together; upon which Mr Willoughby makes this reflection, that if it be poſſible for a man to fly, his wings muſt be ſo contrived and adapted, that he may make uſe of his legs, and not his arms, in managing them.

The tail, Meſſrs Willoughby, Ray, and many others, imagine to be principally employed in ſteering and turning the body in the air, as a rudder; but Borelli has put it beyond all doubt, that this is the leaſt uſe of it, which is chiefly to aſſiſt the bird in its aſcent and deſcent in the air, and to obviate the vacillations of the body and wings; for, as to turning to this or that ſide, it is performed by the wings and inclination of the body, and but very little by the help of the tail. The flying of a bird, in effect, is quite a different thing from the rowing of a veſſel. Birds do not vibrate their wings towards the tail, as oars are ſtruck towards the ſtern, but waft them downwards; nor does the tail of the bird cut the air at right angles as the rudder does the water; but is diſpoſed horizontally, and preſerves the ſame ſituation what way ſoever the bird turns. In effect, as a veſſel is turned about on its centre of gravity to the right, by a briſk application of the oars to the left; ſo a bird, in beating the air with its right wing alone, towards the tail, will turn its fore part to the left. Thus pigeons changing their courſe to the left, would labour it with their right wing, keeping the other almoſt at reſt. Birds of a long neck alter their courſe by the inclination of their head and neck; which altering the courſe of gravity, the bird will proceed in a new direction.

The manner of FLYING is thus. The bird firſt bends his legs, and ſprings with a violent leap from the ground; then opens and expands the joints of his wings, ſo as to make a right line perpendicular to the ſides of his body: thus the wings, with all the feathers therein, conſtitute one continued lamina. Being now raiſed a little above the horizon, and vibrating the wings with great force and velocity perpendicularly againſt the ſubject air, that fluid reſiſts thoſe ſucceſſions, both from its natural inactivity and elaſticity, by means of which the whole body of the bird is protruded. The reſiſtance the air makes to the withdrawing of the wings, and conſequently the progreſs of the bird, will be ſo much the greater, as the waft or ſtroke of the fan of the wing is longer: but as the force of the wing is continually diminiſhed by this reſiſtance, when the two forces continue to be *in equilibrio*, the bird will remain ſuſpended in the ſame place; for the bird only aſcends ſo long as the arch of air the wing deſcribes makes a reſiſtance equal to the exceſs of the ſpecific gravity of the bird above the air. If the air, therefore, be ſo rare as to give way with the ſame velocity as it is ſtruck withal, there will be no reſiſtance, and conſequently the bird can never mount. Birds never fly upwards in a perpendicular line, but always in a parabola. In a direct aſcent, the natural and artificial tendency would oppoſe and deſtroy each other, ſo that the progreſs would be very ſlow. In a direct deſcent they would aid one another, ſo that the fall would be too precipitate. Flying.

Artificial FLYING, that attempted by men, by the aſſiſtance of mechanics.

The art of flying has been attempted by ſeveral perſons in all ages. The Leucadians, out of ſuperſtition, are reported to have had a cuſtom of precipitating a man from a high cliff into the ſea, firſt fixing feathers, variouſly expanded, round his body, in order to break the fall.

Friar Bacon, who lived near 500 years ago, not only affirms the art of flying poſſible, but aſſures us, that he himſelf knew how to make an engine wherein a man ſitting might be able to convey himſelf through the air like a bird; and further adds, that there was then one who had tried it with ſucceſs. The ſecret conſiſted in a couple of large thin hollow copper globes, exhauſted of air; which being much lighter than air, would ſuſtain a chair whereon a perſon might ſit. Father Franciſco Lana, in his *Prodromo*, propoſes the ſame thing, as his own thought. He computes, that a round veſſel of plate braſs, 14 feet in diameter, weighing three ounces the ſquare foot, will only weigh 1848 ounces; whereas a quantity of air of the ſame bulk will weigh 2155$\frac{1}{2}$d ounces; ſo that the globe will not only be ſuſtained in the air, but will carry with it a weight of 373$\frac{1}{2}$d ounces; and by increaſing the bulk of the globe, without increaſing the thickneſs of the metal, he adds, a veſſel might be made to carry a much greater weight.—But the fallacy is obvious: a globe of the dimenſions he deſcribes, Dr Hook ſhows, would not ſuſtain the preſſure of the air, but be cruſhed inwards. Beſides, in whatever ratio the bulk of the globe were increaſed, in the ſame muſt the thickneſs of the metal, and conſequently the weight be increaſed: ſo that there would be no advantage in ſuch augmentation. See AEROSTATION.

The ſame author deſcribes an engine for flying, invented by the Sieur Beſnier, a ſmith of Sable, in the county of Maine. *Vid. Philoſoph. Collect.* N° 1.

The

Flying Bridge || Foetus.

The philoſophers of King Charles the ſecond's reign were mightily buſied about this art. The famous Biſhop Wilkins was ſo confident of ſucceſs in it, that he ſays, he does not queſtion but in future ages it will be as uſual to hear a man call for his wings, when he is going a journey, as it is now to call for his boots.

Flying Bridge. See BRIDGE.

Flying Fiſh, a name given to ſeveral ſpecies of fiſh, which, by means of long fins, can keep themſelves out of the water for ſome time. See EXOCOETUS, ICHTHYOLOGY *Index*.

Flying Pinion, is part of a clock, having a fly or fan whereby to gather air, and ſo bridle the rapidity of the clock's motion, when the weight deſcends in the ſtriking part.

FO, or FOE; an idol of the Chineſe. He was originally worſhipped in the Indies, and tranſported from thence into China, together with the fables with which the Indian books were filled. He is ſaid to have performed moſt wonderful things, which the Chineſe have deſcribed in ſeveral volumes, and repreſented by cuts.

Sect of Fo. See CHINA, N° 104.

Fo-Kien. See FOKIEN.

FOAL, or *Colt and Filly*; the young of the horſe kind. The word *colt*, among dealers, is underſtood of the male, as *filly* is of the female. See COLT.

FOCUS, in *Geometry* and *Conic Sections*, is applied to certain points in the parabola, ellipſis, and hyperbola, where the rays reflected from all parts of theſe curves concur and meet. See *Conic Sections*.

FOCUS, in *Optics*, a point in which any number of rays, after being reflected or refracted, meet.

FODDER, any kind of meat for horſes or other cattle. In ſome places, hay and ſtraw, mingled toghether, is peculiarly denominated *fodder*.

FODDER, in the civil law, is uſed for a prerogative that the prince has, to be provided with corn and other meats for his horſes, by the ſubjects, in his warlike expeditions.

FODDER, among miners, a meaſure containing 22 hundred and a half weight; in London the fodder is only 20 hundred weight.

FODDERING a ſhip. See FOTHERING.

FOENUGREEK. See TRIGONELLA, BOTANY *Index*.

FOENUS NAUTICUM. Where money was lent to a merchant, to be employed in a beneficial trade, with condition to be repaid with extraordinary intereſt, in caſe ſuch voyage was ſafely performed. The agreement was ſometimes called *fœnus nauticum*, ſometimes *uſura maritima*. But as this gave an opening for uſurious and gaming contracts, 19 Geo. II. c. 37. enacts, that all money lent on bottomry, or at *reſpondentia*, on veſſels bound to or from the Eaſt Indies, ſhall be expreſsly lent only upon the ſhip or merchandiſe; the lender to have the benefit of ſalvage, &c. *Blackſt. Com.* ii. 459. *Mol. de Jur. Mar.* 361.

FOETOR, in *Medicine*, fetid effluvia ariſing from the body or any part thereof.

FOETUS, the young of all viviparous animals whilſt in the womb, and of oviparous animals before being hatched: the name is transferred by botaniſts to the *embryos of vegetables*.

Strictly, the name is applied to the young after it is perfectly formed; previous to which it is uſually called EMBRYO. See ANATOMY *Index*. Fog.

In the human fœtus are ſeveral peculiarities not to be found in the adult; ſome of them are as follow. 1. The arteries of the navel ſtring, which are continuations of the hypogaſtrics, are, after the birth, ſhrivelled up, and form the ligamenta umbilic. infer. 2. The veins of the navel ſtring are formed by the union of all the venous branches in the placenta, and paſſing into the abdomen become the falciform ligament of the liver. 3. The lungs, before being inflated with air, are compact and heavy, but after one inſpiration they become light, and as it were ſpongy; and it may be noted here, that the notion of the lungs ſinking in water before the child breathes, and of their ſwimming after the reception of air, are no certain proofs that the child had or had not breathed, much leſs that it was murdered: for the uninflated lungs become ſpecifically lighter than water as ſoon as any degree of putrefaction takes place in them; and this ſoon happens after the death of the child; beſides, where the utmoſt care hath been taken to preſerve the child, it hath breathed once or twice, and then died. 4. The thymus gland is very large in the fœtus, but dwindles away in proportion as years advance. 5. The foramen ovale in the heart of a fœtus, is generally cloſed in an adult.

FOG, or MIST, a meteor, conſiſting of groſs vapours, floating near the ſurface of the earth.

Miſts, according to Lord Bacon, are imperfect condenſations of the air, conſiſting of a large proportion of the air, and a ſmall one of the aqueous vapour; and theſe happen in the winter, about the change of the weather from froſt to thaw, or from thaw to froſt; but in the ſummer, and in the ſpring, from the expanſion of the dew.

If the vapours, which are raiſed plentifully from the earth and waters, either by the ſolar or ſubterraneous heat, do at their firſt entrance into the atmoſphere meet with cold enough to condenſe them to a conſiderable degree, their ſpecific gravity is by that means increaſed, and ſo they will be ſtopped from aſcending; and either return back in form of dew or of drizzling rain, or remain ſuſpended ſome time in the form of a fog. Vapours may be ſeen on the high grounds as well as the low, but more eſpecially about marſhy places. They are eaſily diſſipated by the wind, as alſo by the heat of the ſun. They continue longeſt in the loweſt grounds, becauſe theſe places contain moſt moiſture, and are leaſt expoſed to the action of the wind.

Hence we may eaſily conceive, that fogs are only low clouds, or clouds in the loweſt region of the air; as clouds are no other than fogs raiſed on high. See CLOUD.

When fogs ſtink, then the vapours are mixed with ſulphureous exhalations, which ſmell ſo. Objects viewed through fogs appear larger and more remote than through the common air. Mr Boyle obſerves, that upon the coaſt of Coromandel, and moſt maritime parts of the Eaſt Indies, there are, notwithſtanding the heat of the climate, annual fogs ſo thick, as to occaſion people of other nations who reſide there, and even the more tender ſort of the natives, to keep their houſes cloſe ſhut up.

Fogs are commonly ſtrongly electrified, as appears from

Fogage || Fokien.

from Mr Cavallo's obſervations upon them. See ELECTRICITY.

FOGAGE, in the foreſt law, is rank graſs not eaten up in ſummer.

FOGO, or FUEGO. See FUEGO.

FOHI. See FE; and CHINA, N° 7.

FOIBLE, a French term, frequently uſed alſo in our language. It literally ſignifies *weak*; and in that ſenſe is applied to the body of animals and the parts thereof, as *foible* reins, *foible* ſight, &c. being derived from the Italian *fievole*, of the Latin *flebilis*, to be "lamented, pitied."

But it is chiefly uſed with us ſubſtantively, to denote a defect or flaw in a perſon or thing. Thus we ſay, Every perſon has his foible; and the great ſecret conſiſts in hiding it artfully: Princes are gained by flattery, that is their foible. The foible of young people is pleaſure; the foible of old men is avarice; the foible of the great and learned is vanity; the foible of women and girls, coquetry, or an affectation of having gallants: You ſhould know the forte and the foible of a man before you employ him: We ſhould not let people perceive that we know their foible.

FOIL, in fencing, denotes a blunt ſword, or one that has a button at the end covered with leather, uſed in learning the art of fencing.

FOIL, among glaſs-grinders, a ſheet of tin, with quickſilver, or the like, laid on the backſide of a looking-glaſs, to make it reflect. See FOLIATING.

FOIL, among jewellers, a thin leaf of metal placed under a precious ſtone, in order to make it look tranſparent, and give it an agreeable different colour, either deep or pale: thus, if you want a ſtone to be of a pale colour, put a foil of that colour under it; or if you would have it deep, lay a dark one under it.

Theſe foils are made either of copper, gold, or gold and ſilver together. The copper foils are commonly known by the name of *Nuremberg* or *German foils*; and are prepared as follows: Procure the thinneſt copper plates you can get: beat theſe plates gently upon a well-poliſhed anvil, with a poliſhed hammer, as thin as poſſible; and placing them between two iron plates as thin as writing paper, heat them in the fire; then boil the foil in a pipkin, with equal quantities of tartar and ſalt, conſtantly ſtirring them till by boiling they become white; after which, taking them out and drying them, give them another hammering, till they are made fit for your purpoſe: however, care muſt be taken not to give the foils too much heat, for fear of melting; nor muſt they be too long boiled, for fear of attracting too much ſalt.

The manner of poliſhing theſe foils is as follows: Take a plate of the beſt copper, one foot long and about five or ſix inches wide, poliſhed to the greateſt perfection; bend this to a long convex, faſten it upon a half roll, and fix it to a bench or table; then take ſome chalk, waſhed as clean as poſſible, and filtered through a fine linen cloth, till it be as fine as you can make it; and having laid ſome thereof on the roll, and wetted the copper all over, lay your foils on it, and with a poliſhing ſtone and the chalk poliſh your foils till they are as bright as a looking-glaſs; after which they muſt be dried, and laid up ſecure from duſt.

FOKIEN, a province of China in Aſia, commodiouſly ſituated for navigation and commerce, part of it bordering on the ſea, in which they catch large quantities of fiſh, which they ſend ſalted to other parts of the empire. Its ſhores are very uneven, by reaſon of the number and variety of its bays; and there are many forts built thereon to guard the coaſt. The air is hot, but pure and wholeſome. Folard.

The mountains are almoſt everywhere diſpoſed into a kind of amphitheatres, by the labour of the inhabitants, with terraces placed one above another. The fields are watered with rivers and ſprings, which iſſue out of the mountains, and which the huſbandmen conduct in ſuch a manner as to overflow the fields of rice when they pleaſe, becauſe it thrives beſt in watery ground. They make uſe of pipes of bamboo for this purpoſe.

They have all commodities in common with the reſt of China; but more particularly muſk, precious ſtones, quickſilver, ſilk, hempen cloth, callico, iron, and all ſorts of utenſils wrought to the greateſt perfection. From other countries they have cloves, cinnamon, pepper, ſandal wood, amber, coral, and many other things. The capital city is Fou-tcheou Fou; or, as others would have it written, Fucherofu. But as for Fokien, which moſt geographers make the capital, Groſier informs us there is no ſuch place.

FOLARD, CHARLES, an eminent Frenchman, famous for his ſkill and knowledge in the military art, was born at Avignon in 1669, of a noble family, but not a rich one. He diſcovered an early turn for the ſciences, and a ſtrong paſſion for arms; which laſt was ſo inflamed by reading Cæſar's Commentaries, that he enliſted at 16 years of age. His father got him off, and ſhut him in a monaſtery: but he made his eſcape in about two years after, and entered himſelf a ſecond time in quality of cadet. His inclination for military affairs, and the great pains he took to accompliſh himſelf in that way, recommended him to notice; and he was admitted into the friendſhip of the firſt rate officers. M. de Vendome, who commanded in Italy in 1720, made him his aid-de-camp, having conceived the higheſt regard for him; and ſoon after ſent him with part of his forces into Lombardy. He was entirely truſted by the commander of that army; and no meaſures were concerted, or ſteps taken, without conſulting him. By purſuing his plans, many places were taken, and advantages gained; and ſuch, in ſhort, were his ſervices, that he had a penſion of 400 livres ſettled upon him, and was honoured with the croſs of St Louis. He diſtinguiſhed himſelf greatly, Auguſt 15. 1705, at the battle of Caſſano; where he received a wound upon his left hand, which deprived him of the uſe of it ever after. It was at this battle that he conceived the firſt idea of that ſyſtem of columns, which he afterwards prefixed to his Commentaries upon Polybius. The duke of Orleans ſending De Vendome again into Italy in 1706, Folard had orders to throw himſelf into Modena to defend it againſt Eugene: where, though he acquitted himſelf with his uſual ſkill, he was very near being aſſaſſinated. The deſcription which he has given of the conduct and character of the governor of this town, may be found in his Treatiſe of the Defence of Places, and deſerves to be read. He received a dangerous wound on the thigh at the battle of Malplaquet, and was ſome time after made priſoner by Prince Eugene. Being exchanged in 1711, he was made

Folc-lands. Folcmote. made governor of Bourbourg. In 1714, he went to Malta, to aſſiſt in defending that iſland againſt the Turks. Upon his return to France, he embarked for Sweden, having a paſſionate deſire to ſee Charles XII. He acquired the eſteem and confidence of that famous general, who ſent him to France to negotiate the reeſtabliſhment of James II. upon the throne of England; but that project being dropped, he returned to Sweden, followed Charles XII. in his expedition to Norway, and ſerved under him at the ſiege of Fredericksthall, where that prince was killed, Dec. 11. 1718. Folard then returned to France; and made his laſt campaign in 1719, under the duke of Berwick, in quality of colonel. From that time he applied himſelf intenſely to the ſtudy of the military art as far as it could be ſtudied at home; and built his theories upon the foundation of his experience and obſervations on facts. He contracted an intimacy with Count Saxe, who, as he then declared, would one day prove a very great general. He was choſen a fellow of the Royal Society of London in 1749; and, in 1751, made a journey to Avignon, where he died in 1752, aged 83 years. He was the author of ſeveral works, the principal of which are; 1. Commentaries upon Polybius, in ſix volumes, 4to. 2. A Book of New Diſcoveries in War. 3. A Treatiſe concerning the Defence of Places, &c. in French. Thoſe who would know more of this eminent ſoldier, may conſult a French piece, entitled, *Memoires pour ſervir à l'Hiſtoire de M. le Chevalier de Folard. Ratiſbone*, 1753, 12mo.

FOLC-LANDS, (Sax.) copyhold lands ſo called in the time of the Saxons, as charter-lands were called *boc-lands*, Kitch. 174. *Folkland* was *terra vulgi* or *popularis*; the land of the vulgar people, who had no certain eſtate therein, but held the ſame, under the rents and ſervices accuſtomed or agreed, at the will only of their lord the thane; and it was therefore not put in writing, but accounted *prædium ruſticum et ignobile*. Spelm. of Feuds, c. 5.

FOLCMOTE, or FOLKMOTE, (Sax. *Folcgemote*, i. e. *conventus populi*), is compounded of *folk*, *populus*, and *mote*, or *gemote*, *convenire*; and ſignified originally, as Somner in his Saxon Dictionary informs us, a general aſſembly of the people, to conſider of and order matters of the commonwealth. And Sir Henry Spelman ſays, the *folcmote* was a ſort of annual parliament or convention of the biſhops, thanes, aldermen, and freemen, upon every May-day yearly; where the laymen were ſworn to defend one another and the king, and to preſerve the laws of the kingdom; and then conſulted of the common ſafety. But Dr Brady infers from the laws of the Saxon kings of England, that it was an inferior court, held before the king's *reeve* or ſteward, every month, to do *folk* right, or compoſe ſmaller differences, from whence there lay appeal to the ſuperior courts; *Gloſſ.* p. 48. Squire ſeems to think the *folcmote* not diſtinct from the *ſhiremote*, or common general meeting of the county. See his *Angl. Sax. Gov.* 155. *n.*

Manwood mentions *folcmote* as a court holden in London, wherein all the *folk* and people of the city did complain of the mayor and aldermen, for miſgovernment within the ſaid city; and this word is ſtill in uſe among the Londoners, and denotes *celebrem ex tota civitate conventum*. *Stow's Survey*. According to Kennet, the *folcmote* was a common council of all the inhabitants of a city, town, or borough, convened often by found of bell, to the *Mote Hall*, or *Houſe*; or it was applied to a larger congreſs of all the freemen within a county, called the *ſhiremote*, where formerly all knights and military tenants did fealty to the king, and elected the annual ſheriff on the 1ſt of October; till this popular election, to avoid tumults and riots, devolved to the king's nomination, anno 1315, 3 Edw. I. After which the city *folkmote* was ſwallowed up in a ſelect committee or common council, and the country *folkmote* in the ſheriff's tourn and aſſizes.

Foreign Foliating.

The word *folkmote* was alſo uſed for any kind of popular or public meeting; as of all the tenants at the *court lect*, or *court baron*, in which ſignification it was of a leſs extent. *Paroch. Antiq.* 120.

FOLENGIO, THEOPHILUS, an Italian poet, was a native of Mantua. He was known alſo by the title of *Merlin Coccaye*, a name which he gave to a poem, and which has been adopted ever ſince for all trifling performances of the ſame ſpecies, conſiſting of buffoonery, puns, anagrams, wit without wiſdom, and humour without good ſenſe. His poem was called The Macaroni, from an Italian cake of the ſame name, which is ſweet to the taſte, but has not the leaſt alimentary virtue, on the contrary palls the appetite and cloys the ſtomach. Theſe idle poems, however, became the reigning taſte in Italy and in France; they gave birth to macaroni academies; and, reaching England, to macaroni clubs; till, in the end, every thing inſipid, contemptible, and ridiculous, in the character, dreſs, or behaviour, of both men and women, is now ſummed up in the deſpicable appellation of *a macaroni*. Folengio died in 1544.

FOLIA, among botaniſts, particularly ſignify the leaves of plants; thoſe of flowers being expreſſed by the word *petals*. See BOTANY.

FOLIAGE, a cluſter or aſſemblage of flowers, leaves, branches, &c.

FOLIAGE, is particularly uſed for the repreſentations of ſuch flowers, leaves, branches, rinds, &c. whether natural or artificial, as are uſed for enrichments on capitals, friezes, pediments, &c.

FOLIATING *of* LOOKING-GLASSES, the ſpreading the plates over, after they are poliſhed, with quickſilver, &c. in order to reflect the image. It is performed thus: A thin blotting paper is ſpread on the table, and ſprinkled with fine chalk; and then a fine lamina or leaf of tin, called *foil*, is laid over the paper; upon this is poured mercury, which is to be diſtributed equally over the leaf with a hare's foot or cotton; over this is laid a clean paper, and over that the glaſs plate, which is preſſed down with the right hand, and the paper gently drawn out with the left: this being done, the plate is covered with a thicker paper, and loaded with a greater weight, that the ſuperfluous mercury may be driven out and the tin adhere more cloſely to the glaſs. When it is dried, the weight is removed, and the looking-glaſs is complete.

Some add an ounce of marcaſite, melted by the fire; and, leſt the mercury ſhould evaporate in ſmoke, they pour it into cold water; and when cooled, ſqueeze through a cloth, or through leather.

Some add a quarter of an ounce of tin and lead to the marcaſite, that the glaſs may dry the ſooner.

FOLIATING *of Globe looking-glaſſes*, is done as follows.

Folio || Folkes.

lows: Take five ounces of quickſilver and one ounce of biſmuth; of lead and tin, half an ounce each: firſt put the lead and tin into fuſion, then put in the biſmuth; and when you perceive that in fuſion too, let it ſtand till it is almoſt cold, and pour the quickſilver into it: after this, take the glaſs globe, which muſt be very clean, and the inſide free from duſt: make a paper funnel, which put into the hole of the globe, as near the glaſs as you can, ſo that the amalgam, when you pour it in, may not ſplath, and cauſe the glaſs to be full of ſpots; pour it in gently, and move it about, ſo that the amalgam may touch everywhere: if you find the amalgam begin to be curdly and fixed, then hold it over a gentle fire, and it will eaſily flow again; and if you find the amalgam too thin, add a little more lead, tin, and biſmuth to it. The finer and clearer your globe is, the better will the looking glaſs be.

Dr Shaw obſerves, that this operation has conſiderable advantages, as being performable in the cold; and that it is not attended with the danger of poiſonous fumes from arſenic, or other unwholeſome matters, uſually employed for this purpoſe: beſides, how far it is applicable to the more commodious foliating of the common looking glaſſes, and other ſpeculums, he thinks, may deſerve to be conſidered.

FOLIO, in merchants books, denotes a page, or rather both the right and left hand pages, theſe being expreſſed by the ſame figure, and correſponding to each other. See BOOK-KEEPING.

FOLIO, among printers and bookſellers, the largeſt form of books, when each ſheet is ſo printed that it may be bound up in two leaves only.

FOLIS. See FOLLIS.

FOLIUM, or LEAF, in *Botany*. See LEAF.

FOLKES, MARTIN, a philoſopher and antiquarian of conſiderable eminence, was born in Weſtminſter in the year 1690. A Mr Cappel, once profeſſor of Hebrew at Saumur, was his private tutor. When 17 years of age, he was ſent to Clare-hall, Cambridge, where he ſucceſsfully applied himſelf to the ſtudy of philoſophy and the mathematics; and when only twenty-three years of age he was choſen a fellow of the Royal Society. His ingenious communications acquired him ſo much applauſe, that he was frequently choſen into its council. He was in habits of friendſhip with the illuſtrious Newton, at that time preſident, and by his influence was elected one of the vice-preſidents in the year 1723. Mr Folkes became a candidate for the chair on the death of Sir Iſaac Newton; but the ſuperior intereſt of Sir Hans Sloane rendered his application ineffectual. In 1733, and the two ſubſequent years, his reſidence was for the moſt part in Italy, with the view of improving himſelf in the knowledge of claſſical antiquities. To aſcertain the weight and value of ancient coins, he carefully conſulted the cabinets of the curious; and on his return home he preſented to the Antiquarian Society, of which he was a member, a diſſertation on this ſubject. He read before the ſame learned body, a diſſertation on the meaſurement of Trajan's and Antonine's pillars, together with other remains of antiquity. The fruits of his obſervations he preſented to the Royal Society; and, in particular, "Remarks on the ſtandard meaſure preſerved in the Capitol of Rome," and the model of an ancient globe in the Farneſian palace. He viſited Paris in 1739, where he was received with great reſpect, and honoured with the company of the moſt eminent literary characters in that metropolis. This reſpect indeed he was entitled to by his unwearied application to many branches of knowledge which were both curious and uſeful. His valuable work, entitled "A table of Engliſh ſilver coins, from the Norman Conqueſt to the preſent time, with their weights, intrinſic values, and ſome remarks upon the ſeveral pieces," was printed in the year 1745. Among the many honours conferred upon Mr Folkes, he was created doctor of laws by both univerſities, and choſen preſident of the Antiquarian Society. He continued to furniſh the Philoſophical Tranſactions with many learned papers, till his career was ſtopped by a paralytic ſtroke, which terminated his uſeful life in the year 1754. He was a man of very extenſive knowledge and great accuracy; but the chief benefit to ſcience which reſulted from his labours, was his treatiſe on the intricate ſubject of coins, weights, and meaſures. His cabinet and library were large and valuable, and expoſed to public ſale after his death. His private character was diſtinguiſhed for politeneſs, generoſity, and friendſhip.

Folkeſtone || Pollis.

FOLKESTONE, a town of Kent, between Dover and Hythe, 72 miles from London, appears to have been a very ancient place, from the Roman coins and Britiſh bricks often found in it. Stillingfleet and Tanner take it for the *Lapis Tituli* of Nennius. It was burnt by Earl Godwin, and by the French in the reign of Edward III. It had five churches, now reduced to one. It is a member of the town and port of Dover: and has a weekly market and an annual fair. It is chiefly noted for the multitude of fiſhing-boats that belong to its harbour, which are employed in the ſeaſon in catching mackerel for London; to which they are carried by the mackerel boats of London and Barking. About Michaelmas, the Folkeſtone barks, with others for Suſſex, go away to the Suffolk and Norfolk coaſts, to catch herrings for the merchants of Yarmouth and Leoſtoff.—Folkeſtone gives the title of *Viſcount* to William Henry Bouverie, whoſe grandfather, Jacob, was ſo created in 1747. It has been obſerved of ſome hills in this neighbourhood, that they have viſibly ſunk and grown lower within memory.

FOLKLAND, and FOLKMOTE. See FOLCLAND.

FOLLICULUS, (from *follis*, "a bag,") a ſpecies of ſeed-veſſel firſt mentioned by Linnæus in his *Delineatio Plantæ*, generally conſiſting of one valve, which opens from bottom to top on one ſide, and has no future for faſtening or attaching the ſeeds within it.

FOLLICULI are likewiſe defined by the ſame author to be ſmall glandular veſſels diſtended with air, which appear on the ſurface of ſome plants; as at the root of water-milfoil, and on the leaves of aldrovanda. In the former, the veſſels in queſtion are roundiſh, and furniſhed with an appearance like two horns; in the latter, pot-ſhaped, and ſemicircular.

FOLLIS, or FOLIS, anciently ſignified a little bag or purſe; whence it came to be uſed for a ſum of money, and very different ſums were called by that name: thus the ſcholiaſt on the Baſilics mentions a follis of copper which was worth but the 24th part of the miliarenſis; the gloſſæ nomicæ, quoted by Gronovius and others, one of 125 miliarenſes, and another of 250 denarii, which was the ancient ſeſtertium; and three different ſums of eight, four, and two pound of gold, were each

Folly || Fong-Yang.

each called *follis*. According to the account of the ſcholiaſt, the ounce of ſilver, which contained five miliarenſes of 60 in the pound, was worth 120 folles of copper. The gloſſographer, deſcribing a follis of 250 denarii, ſays it was equal to 312 pounds 6 ounces of copper, and as the denarius of that age was the 8th part of an ounce, an ounce of ſilver muſt have been worth 120 ounces of copper; and therefore the ſcholiaſt's follis was an ounce of copper, and equal to the gloſſographer's nummus. But as Conſtantine's copper money weighed a quarter of a Roman ounce, the ſcholiaſt's follis and the gloſſographer's nummus contained four of them, as the ancient nummus contained four aſſes.

FOLLY, according to Mr Locke, conſiſts in the drawing of falſe concluſions from juſt principles; by which it is diſtinguiſhed from madneſs, which draws juſt concluſions from falſe principles.

But this ſeems too confined a definition; *folly*, in its moſt general acceptation, denoting a weakneſs of intellect or apprehenſion, or ſome partial abſurdity in ſentiment or conduct.

FOMAHAUT, in *Aſtronomy*, a ſtar of the firſt magnitude in the conſtellation AQUARIUS.

FOMENTATION, in *Medicine*, is a fluid externally applied, uſually as warm as the patient can bear it, and in the following manner. Two flannel cloths are dipped into the heated liquor, one of which is wrung as dry as the neceſſary ſpeed will admit, then immediately applied to the part affected; it lies on until the heat begins to go off, and the other is in readineſs to apply at the inſtant in which the firſt is removed: thus theſe flannels are alternately applied, ſo as to keep the affected part conſtantly ſupplied with them warm. This is continued 15 or 20 minutes, and repeated two or three times a-day.

Every intention of relaxing and ſoothing by fomentations may be anſwered as well by warm water alone as when the whole tribe of emollients are boiled in it; but when diſcutients or antiſeptics are required, ſuch ingredients muſt be called in as are adapted to that end.

The degree of heat ſhould never exceed that of producing a pleaſing ſenſation; great heat produces effects very oppoſite to that intended by the uſe of fomentations.

FONG-YANG, a city of China, in the province of *Kiang-Nan*. It is ſituated on a mountain, which hangs over the Yellow river, and encloſes with its walls ſeveral fertile little hills. Its juriſdiction is very extenſive: for it comprehends 18 cities; five of which are of the ſecond, and 13 of the third claſs. As this was the birth-place of the emperor Hong-vou, chief of the preceding dynaſty, this prince formed a deſign of rendering it a famous and magnificent city, in order to make it the ſeat of empire. After having expelled the Weſtern Tartars, who had taken poſſeſſion of China, he transferred his court hither, and named the city *Fong-yang*; that is to ſay, "The Place of the Eagle's Splendour." His intention, as we have ſaid, was to beautify and enlarge it; but the inequality of the ground, the ſcarcity of freſh water, and above all the vicinity of his father's tomb, made him change his deſign. By the unanimous advice of his principal officers, this prince eſtabliſhed his court at NAN-KING, a more beautiful and commodious place. When he had formed this reſolution, a Fong-Chou || Portaire

was put to the intended works: the imperial palace which was to have been incloſed by a triple wall, the walls of the city to which a circumference of nine leagues were aſſigned, and the canals that were begun, all were abandoned; and nothing was finiſhed, but three monuments that ſtill remain. The extent and magnificence of theſe ſufficiently ſhow what the beauty of this city would have been, had the emperor purſued his original deſign. The firſt is the tomb of the father of Hong-vou, to decorate which no expence was ſpared; it is called *Hoan-lin*, or the *Royal Tomb*. The ſecond is a tower built in the middle of the city, which is of an oblong form, and 100 feet high. The third is a magnificent temple erected to the god Fo. At firſt it was only a pagod, to which Hong-vou retired after having loſt his parents, and where he was admitted as an inferior domeſtic; but, having ſoon become weary of this kind of life, he enliſted with the chief of a band of banditti, who had revolted from the Tartars. As he was bold and enterpriſing, the general made choice of him for his ſon-in-law; ſoon after, he was declared his ſucceſſor by the unanimous voice of the troops. The new chief, ſeeing himſelf at the head of a large party, had the preſumption to carry his views to the throne. The Tartars, informed of the progreſs of his arms, ſent a numerous army into the field; but he ſurpriſed and attacked them with ſo much impetuoſity, that they were obliged to fly; and, though they ſeveral times returned to the charge, they were ſtill defeated, and at length driven entirely out of China. As ſoon as he mounted the throne, he cauſed the ſuperb temple which we have mentioned to be raiſed out of gratitude to the Bonzes, who had received him in his diſtreſs, and aſſigned them a revenue ſufficient for the maintenance of 300 perſons, under a chief of their own ſect, whom he conſtituted a mandarin, with power of governing them, independent of the officers of the city. This pagod was ſupported as long as the preceding dynaſty laſted; but that of the Eaſtern Tartars, which ſucceeded, ſuffered it to fall to ruin.

Fong-Choui, the name of a ridiculous ſuperſtition among the Chineſe. See CHINA, N° 105.

FONT, among eccleſiaſtical writers, a large baſon in which water is kept for the baptizing of infants or other perſons.

FONT, in the art of printing, denotes a complete aſſortment of letters, accents, &c. uſed in printing See FOUNT.

FONTAINE, JOHN, the celebrated French poet, and one of the firſt-rate geniuſes of his age, was born at Chateau-Thierri in Champagne, the 8th of July 1621, of a good family. At the age of 19 he entered amongſt the Oratorians, but quitted that order 18 months after. He was 22 years of age before he knew his own talents for poetry; but hearing an ode of Malherbe read, upon the aſſaſſination of Henry IV. he was ſo taken with admiration of it, that the poetical fire, which had before lain dormant within him, ſeemed to be enkindled from that of the other great poet. He applied himſelf to read, to meditate, to repeat, in fine to imitate, the works of Malherbe. The firſt eſſays of his pen he confined to one of his relations who made him read the beſt Latin authors, Horace, Virgil, Terence, Quintilian, &c. and then the beſt

Fontaine. beſt compoſitions in French and Italian. He applied himſelf likewiſe to the ſtudy of the Greek authors, particularly Plato and Plutarch. Some time afterwards his parents made him marry a daughter of a lieutenant-general, a relation of the great Racine. This young lady, beſides her very great beauty, was remarkable for the delicacy of her wit, and Fontaine never compoſed any work without conſulting her. But as her temper was none of the beſt, to avoid diſſenſion, he ſeparated himſelf from her company as often as he well could. The famous ducheſs of Bouillon, niece to Cardinal Mazarine, being exiled to Chateau-Thierri, took particular notice of Fontaine. Upon her recal, he followed her to Paris; where by the intereſt of one of his relations, he got a penſion ſettled upon him. He met with great friends and protectors amongſt the moſt diſtinguiſhed perſons of the court, but Madame de la Sabliere was the moſt particular. She took him to live at her houſe, and it was then that Fontaine, diveſted of domeſtic concerns, led a life conformable to his diſpoſition, and cultivated an acquaintance with all the great men of the age. It was his cuſtom, after he was fixed at Paris, to go every year, during the month of September, to his native place of Chateau-Thierri, and pay a viſit to his wife, carrying with him Racine, Deſpreaux, Chapelle, or ſome other celebrated writers. When he has ſometimes gone thither alone by himſelf, he has come away without remembering even to call upon her; but ſeldom omitted ſelling ſome part of his lands, by which means he ſquandered away a conſiderable fortune. After the death of Madame de la Sabliere, he was invited into England, particularly by Madame Mazarine, and by St Evremond, who promiſed him all the ſweets and comforts of life; but the difficulty of learning the Engliſh language, and the liberality of the duke of Burgundy, prevented his voyage.

About the end of the year 1692 he fell dangerouſly ill; and, as is cuſtomary upon theſe occaſions in the Romiſh church, he made a general confeſſion of his whole life to P. Poguet, an Oratorian; and, before he received the ſacrament, he ſent for the gentlemen of the French Academy, and in their preſence declared his ſincere compunction for having compoſed his Tales; a work he could not reflect upon without the greateſt repentance and deteſtation; promiſing that if it ſhould pleaſe God to reſtore his health, he would employ his talents only in writing upon matters of morality or piety. He ſurvived this illneſs two years, living in the moſt exemplary and edifying manner, and died the 13th of March 1695, being 74 years of age. When they ſtripped his body, they found next his ſkin a hair ſhirt; which gave room for the following expreſſion of the younger Racine:

Et l'Auteur de Jaconde eſt orné d'un Cilice.

Fontaine's character is remarkable for a ſimplicity, candour, and probity, ſeldom to be met with. He was of an obliging diſpoſition; cultivating a real friendſhip with his brother poets and authors; and what is very rare, beloved and eſteemed by them all. His converſation was neither gay nor brilliant, eſpecially when he was not amongſt his intimate friends. One day being invited to a dinner at a farmer general's, he ate a great deal, but did not ſpeak. Riſing up from table very early, under pretext of going to the academy, one of the company repreſented to him that it was not yet a proper time: "Well (ſays he), if it is not, I will ſtay a little longer." He had one ſon by his wife in the year 1660. At the age of 14, he put him into the hands of M. de Harley, the firſt preſident, recommending to him his education and fortune. It is ſaid, that having been a long time without ſeeing him, he happened to meet him one day viſiting, without recollecting him again, and mentioned to the company that he thought that young man had a good deal of wit and underſtanding. When they told him it was his own ſon, he anſwered in the moſt tranquil manner, "Ha! truly I am glad on't." An indifference, or rather an abſence of mind, influenced his whole conduct, and rendered him often inſenſible to the inclemency of the weather. Madame de Bouillon going one morning to Verſailles, ſaw him, abſtracted in thought, ſitting in an arbour; returning at night, ſhe found him in the ſame place, and in the ſame attitude, although it was very cold, and had rained almoſt the whole day. He carried this ſimplicity ſo far, that he was ſcarcely ſenſible of the bad effects ſome of his writings might occaſion, particularly his Tales. In a great ſickneſs, his confeſſor exhorting him to prayer and alms deeds: "As for alms deeds (replied Fontaine), I am not able, having nothing to give; but they are about publiſhing a new edition of my Tales, and the bookſeller owes me a hundred copies; you ſhall have them to ſell, and diſtribute their amount amongſt the poor." Another time P. Poguet exhorting him to repent of his faults, "If he has committed any (cried the nurſe), I am ſure it is more from ignorance than malice, for he has as much ſimplicity as an infant." One time having compoſed a tale, wherein he made a profane application of thoſe words of the Goſpel, "Lord, five talents thou didſt deliver to me," he dedicated it, by a moſt ingenious prologue, to the celebrated Arnauld, telling him, it was to ſhow to poſterity the great eſteem he had for the learned doctor. He was not ſenſible of the indecency of the dedication, and the profane application of the text, till Boileau and Racine repreſented it to him. He addreſſed another, by a dedication in the ſame manner, to the archbiſhop of Paris. His Fables are an immortal work, exceeding every thing in that kind, both ancient and modern, in the opinion of the learned. People of taſte, the oftener they read them, will find continually new beauties and charms, not to be met with elſewhere. The deſcendants of this great poet are exempted in France from all taxes and impoſitions; a privilege which the intendants of Soiſſons to this day think it an honour to confirm to them.

FONTAINBLEAU, a town in the Iſle of France, and in the Gatinois, remarkable for its fine palace, which has been the place where the kings of France uſed to lodge when they went a hunting. It was firſt embelliſhed by Francis I. and every ſucceſſive king has added ſomething to it; ſo that it may now be called the fineſt pleaſure houſe in the world. It ſtands in the midſt of a foreſt, conſiſting of 26,424 arpents of land, each containing 100 ſquare perches, and each perch 18 feet. E. Long. 2. 33. N. Lat. 40. 22.

Fontaine II. Fontaines.

FONTAINES, Peter Francis, a French critic, was born of a good family at Rouen in 1685. At 15, he entered into the ſociety of the Jeſuits; and at 30, quitted

Fontaines || Fontarabia.

quitted it, for the ſake of returning to the world. He was a prieſt, and had a cure in Normandy; but left it, and was, as a man of wit and letters, ſome time with the cardinal d'Auvergne. Having excited ſome attention at Paris by certain critical productions, the Abbé Bignon in 1724 committed to him the *Journal des Sçavans*. He acquitted himſelf well in this department, and was peaceably enjoying the applauſes of the public, when his enemies, whom by critical ſtrictures in his Journal he had made ſuch, formed an accuſation againſt him of a moſt abominable crime, and procured him to be impriſoned. By the credit of powerful friends, he was ſet at liberty in 15 days: the magiſtrate of the police took upon himſelf the trouble of juſtifying him in a letter to the Abbé Bignon; and this letter having been read amidſt his fellow labourers in the Journal, he was unanimouſly re-eſtabliſhed in his former credit. This happened in 1725. But with whatever repute he might acquit himſelf in this Journal, frequent diſguſts made him frequently abandon it. He laboured meanwhile in ſome new periodical works, from which he derived his greateſt fame. In 1731, he began one under the title of *Nouvelliſte du Parnaſſe, ou Reflections ſur les Ouvrages nouveaux*: but only proceeded to two volumes; the work having been ſuppreſſed by authority, from the inceſſant complaints of authors ridiculed therein. About three years after, in 1735, he obtained a new privilege for a periodical production, entitled, *Obſervations ſur les Ecrits Modernes*; which, after continuing to 33 volumes, was ſuppreſſed again in 1743. Yet the year following, 1774, he publiſhed another weekly paper, called, *Jugemens ſur les Ouvrages nouveaux*, and proceeded to 11 volumes: the two laſt being done by other hands. In 1745, he was attacked with a diſorder in the breaſt, which ended in a dropſy that proved fatal in five weeks. "He was (ſays M. Freron) born a ſentimental perſon; a philoſopher in conduct as well as in principle; exempt from ambition; and of a noble firm ſpirit, which would not ſubmit to ſue for preferments or titles. In common converſation he appeared only a common man: but when ſubjects of literature, or any thing out of the ordinary way, were agitated, he diſcovered great force of imagination and wit." Beſides the periodical works mentioned above, he was the author of many others: his biographer gives us no leſs then 17 articles; many of them critical, ſome hiſtorical, and ſome tranſlations from Engliſh writers, chiefly from Pope, Swift, Fielding, &c. The Abbé de la Porte, publiſhed, in 1757, *L'Eſprit de l'Abbé des Fontaines*, in 4 vols. 12mo; prefixed to which is the Life of Fontaines, a catalogue of his works, and another catalogue of writings againſt him.

FONTANELLA, in *Anatomy*, imports the quadrangular aperture found betwixt the os frontis and oſſa ſincipitis, in children juſt born; which is alſo called *fons pulſatilis*.

FONTARABIA, a ſea port town of Spain, in Biſcay, and in the territory of Guipuſcoa, ſeated on a peninſula on the ſea ſhore, and on the river Bidaſſoa. It is ſmall, but well fortified both by nature and art; and has a good harbour, though dry at low water. It is built in the form of an amphitheatre, on the declivity of a hill, and ſurrounded on the land ſide by the lofty Pyrenean mountains. It is a very important place, being accounted the key of Spain on that ſide. W. Long. 1. 43. N. Lat. 43. 23. Fontenelle.

FONTENELLE, Bernard le Bovier de, was a man of letters, born at Rouen in 1657, the moſt univerſal genius of the age of Louis XIV. in the eſtimation of Voltaire. He received his education in the college of Jeſuits at Rouen, where the quickneſs of his parts became conſpicuous at a very early period. He was capable of writing Latin verſes when only 13, which were deemed worthy of being publiſhed. He ſtudied the law at the deſire of his father; but as he loſt the very firſt cauſe in which he was employed as an advocate, he became diſguſted with his profeſſion, and devoted himſelf entirely to literature and philoſophy. He compoſed a conſiderable part of the operas of Pſyche and Bellerophon, which were printed under the name of his uncle Thomas Corneille. He wrote a tragedy called *Aſpar*, but as it did not ſucceed, he conſigned the manuſcript to the flames, and never afterwards attempted that ſpecies of compoſition. His Dialogues of the dead were publiſhed in the year 1683, which were well received, as a ſpecimen of elegant compoſition, combining morality with the charms of literature. His "Lettres du Chevalier d'Her," publiſhed in 1685 without his name, diſcovered much wit and ingenuity, but at the ſame time no ſmall ſhare of affectation. His "Entretiens ſur la Pluralité des Mondes," has been regarded as one of his ableſt performances, combining ſcience and philoſophy with vivacity and humour, a talent which may be ſaid to belong almoſt excluſively to the French. It was peruſed by all, and tranſlated into ſeveral foreign languages.

In his "Hiſtory of Oracles," he ſupported the opinion that oracles were forgeries, in oppoſition to thoſe who contended that they were ſupernatural operations of evil ſpirits, put to ſilence by the appearing of Chriſt, and of conſequence he expoſed himſelf to clerical animadverſion. His "Paſtoral Poems" appeared in the year 1688, with a diſcourſe on the nature of the eclogue, which were very much admired for their delicacy of ſentiment, as was alſo his opera of "Thetis and Peleus;" but his "Æneas and Lavinia" was not ſo ſucceſsful. In the year 1699, Fontenelle was choſen ſecretary of the Academy of Sciences, which office he held during the long period of 42 years. He publiſhed a volume annually of the hiſtory of that learned body, filled with analyſes of memoirs, and eulogiums on deceaſed members.

As a poet, he did not riſe above elegance and ingenuity; as a man of ſcience, he rather excelled in throwing light on the inventions of others, than in diſcovering any new truth himſelf, and as a general writer, he united ſolid ſenſe with the delicacy and refinement of a man of wit. He ſtudied his own happineſs as much as moſt men, but he never ſacrificed to the promotion of it, the duties of a man of honour and virtue. He had many friends, and towards the cloſe of life, ſcarcely a ſingle enemy. He was never married, and for a man of letters he acquired conſiderable affluence. Although of a delicate conſtitution, he reached the great age of 90 without any complaint but dullneſs of hearing. He died on the 9th of January 1757, being almoſt a hundred years of age. When aſked by a certain

Fontency || Food.

person how he could pass so easily through the world, he replied, "by virtue of these two axioms; All is possible, and every one is in the right."

FONTENOY, a town or village of the Austrian Netherlands, in the province of Hainault, and on the borders of Flanders; remarkable for a battle fought between the allies and the French on the first of May 1745. The French were commanded by Marechal Saxe, and the allies by the Duke of Cumberland. On account of the superior numbers of the French army, and the superior generalship of their commander, the allies were defeated with great slaughter. The British troops behaved with great intrepidity, as their enemies themselves acknowledged. It has been said, that the battle was lost through the cowardice of the Dutch, who failed in their attack on the village of Fontenoy, on which the event of the day depended. E. Long. 2. 20. N. Lat. 50. 35.

FONTENOY, a village of France, in the duchy of Burgundy, remarkable for a bloody battle fought there in 841, between the Germans and the French, in which were killed above 100,000 men; and the Germans were defeated. E. Long. 3. 43. N. Lat. 47. 28.

FONTEVRAUD, or FRONTEVAUX, Order of, in ecclesiastical history, a religious order instituted about the latter end of the 11th century, and taken under the protection of the holy see by Pope Pascal II. in 1106, confirmed by a bull in 1113, and invested by his successors with very extraordinary privileges. The chief of this order is a female, who is appointed to inspect both the monks and nuns. The order was divided into four provinces, which were those of France, Aquitaine, Auvergne, and Bretagne, in each of which they had formerly several priories.

FONTICULUS, or FONTANELLA, in *Surgery*, an issue, seton, or small ulcer, made in various parts of the body, in order to excite irritation, or to produce the discharge of matter.

FONTINALIA, or FONTANALIA, in antiquity, a religious feast held among the Romans in honour of the deities who presided over fountains or springs. Varro observes, that it was the custom to visit the wells on those days, and to cast crowns into fountains. Scaliger, in his conjectures on Varro, takes this not to be a feast of fountains in general, as Festus insinuates, but of the fountain which had a temple at Rome, near the Porta Capena, called also *Porta Fontinalis*: he adds, that it is of this fountain Cicero speaks in his second book *De Legibus*. The fontinalia were held on the 13th of October.

FONTINALIS, WATER-MOSS, a genus of plants belonging to the cryptogamia class, and to the order of musci. See BOTANY *Index*.

FOOD, in the most extensive signification of the word, implies whatever aliments are taken into the body, whether solid or fluid; but in common language, it is generally used to signify only the solid part of our aliment.

We are told, that in the first ages men lived upon acorns, berries, and such fruits as the earth spontaneously produces; then they proceeded to eat the flesh of wild animals taken in hunting: But their numbers decreasing and mankind multiplying, necessity taught them the art of cultivating the ground, to sow corn, &c. By and by they began to assign to each other, by general consent, portions of land to produce them their supply of vegetables; after this, reason suggested the expedient of domesticating certain animals, both to assist them in their labours and supply them with food. Hogs were the first animals of the domestic kind that appeared upon their tables; they held it to be ungrateful to devour the beasts that assisted them in their labours.—When they began to make a free use of domestic animals, they roasted them only: boiling was a refinement in cookery which for ages they were strangers to; and fish living in an element men were unused to, were not eaten till they grew somewhat civilized. Menelaus complains, in the Odyssey, that they had been constrained to feed upon them. Food.

The most remarkable distinction of foods, in a medical view, is into those which are already assimilated into the animal nature, and such as are not. Of the first kind are animal substances in general; which if not entirely similar, are nearly so, to our nature. The second comprehends vegetables, which are much more difficultly assimilated. But as the nourishment of all animals, even those which live on other animals, can be traced originally to the vegetable kingdom, it is plain, that the principle of all nourishment is in vegetables.

Though there is perhaps no vegetable which does not afford nourishment to some species of animals or other; yet, with regard to mankind, a very considerable distinction is to be made. Those vegetables which are of a mild, bland, agreeable taste, are proper nourishment; while those of an acrid, bitter, and nauseous nature, are improper. We use, indeed, several acrid substances as food; but the mild, the bland, and agreeable, are in the largest proportion in almost every vegetable. Such as are very acrid, and at the same time of an aromatic nature, are not used as food, but as spices or condiments, which answer the purposes of medicines rather than any thing else. Sometimes, indeed, acrid and bitter vegetables seem to be admitted as food. Thus celeri and endive are used in common food, though both are substances of considerable acrimony; but it must be observed, that, when we use them, they are previously blanched, which almost totally destroys their acrimony. Or if we employ other acrid substances, we generally, in a great measure, deprive them of their acrimony by boiling. In different countries, the same plants grow with different degrees of acrimony. Thus, garlic here seldom enters our food; but in the southern countries, where the plants grow more mild, they are frequently used for that purpose. The plant which furnishes cassada, being very acrimonious, and even poisonous, in its recent state, affords an instance of the necessity of preparing acrid substances even in the hot countries: and there are other plants, such as arum root, which are so exceedingly acrimonious in their natural state, that they cannot be swallowed with safety; yet, when deprived of that acrimony, will afford good nourishment. *Cullen on the Mat. Med.* 1st edit.

The most remarkable properties of different vegetable substances as food, are taken notice of under their different names: here we shall only compare vegetable foods in general with those of the animal kind.

I. *In the Stomach*, they differ remarkably, in that the vegetables always have a tendency to acidity, while animal

Food. animal food of all kinds rather tends to alkalescency and putrefaction. Some animal foods, indeed, turn manifestly acid before they putrefy; and it has been asserted, that some degree of acescency takes place in every kind of animal food before digestion. This acescency of animal food, however, never comes to any morbid degree, but the disease is always on the side of putrescency. The acescency of vegetables is more frequent, and ought to be more attended to, than the alkalescency of animal food; which last, even in weak stomachs, is seldom felt; while acescency greatly affects both the stomach and system.

With regard to their difference of *solution*:—Heaviness, as it is called, is seldom felt from vegetables, except from tough farinaceous paste, or the most viscid substances; while the heaviness of animal food is more frequently noticed, especially when in any great quantity. Difficulty of solution does not depend so much on firmness of texture (as a man, from fish of all kinds, is more oppressed than from firmer substances) as on viscidity; and hence it is more frequent in animal food, especially in the younger animals.

With regard to *mixture*:—There is no instance of difficult mixture in vegetables, except in vegetable oils; while animal foods, from both viscidity and oiliness, especially the fatter meats, are refractory in this respect. Perhaps the difference of animal and vegetable foods might be referred to this head of mixture. For vegetable food continues long in the stomach, giving little stimulus: Now the system is affected in proportion to the extent of this stimulus, which is incomparably greater from the animal viscid oily food, than from the vegetable, firmer, and more aqueous. However, there are certain applications to the stomach, which have a tendency to bring on the cold fit of fever, independent of stimulus, merely by their refrigeration: and this oftener arises from vegetables; as we see, in those hot countries where intermittents prevail, they are oftener induced from a surfeit of vegetable than of animal food. A proof of this is, that when one is recovering of an intermittent, there is nothing more apt to cause a relapse than cold food, especially if taken on those days when the fit should return, and particularly acescent, fermentable vegetables, as salads, melons, cucumbers, &c. *ceido-dulces*, &c. which, according to Dr Cullen, are the most frequent causes of epidemics; therefore, when an intermittent is to be avoided, we shun vegetable diet, and give animal foods, although their stimulus be greater.

II. *In the Intestines.* When the putrescency of animal food has gone too far, it produces an active stimulus, causing diarrhœa, dysentery, &c. But these effects are but rare; whereas from vegetable food and its acid, which, united with the bile, proves a pretty strong stimulus, they more frequently occur; but, luckily, are of less consequence, if the refrigeration is not very great. In the autumnal season, when there is a tendency to dysentery, if it is observed that eating of fruits brings it on, it is rather to be ascribed to their cooling than stimulating the intestines.

As to *stool*:—Wherever neither putrefaction nor acidity has gone a great length, animal food keeps the belly more regular. Vegetable food gives a greater proportion of succulent matter, and, when exsiccated by the stomach and intestines, is more apt to stagnate, and produce slow belly and costiveness, than animal stimulating food; which, before it comes to the great guts, where stoppage is made, has obtained a putrefactive tendency, and gives a proper stimulus: and thus those who are costive from the use of vegetable; when they have recourse to animal food are in this respect better. Food.

III. *In the blood-vessels.* They both give a blood of the same kind, but of different quality. Animal food gives it in greater quantity, being in great part, as the expression is, convertible *in succum et sanguinem*, and of easy digestion; whereas vegetable is more watery, and contains a portion of unconquerable saline matter, which causes it to be thrown out of the body by some excretion. Animal food affords a more dense stimulating elastic blood than vegetable; stretching and causing a great resistance in the solids, and again exciting their stronger action. It has been supposed that acescency of vegetable food is carried into the blood-vessels, and there exerts its effects; but the tendency of animal fluids is so strong to alkalescency, that the existence of an acid acrimony in the blood seems very improbable. Animal food alone will soon produce an alkalescent acrimony; and if a person who lives entirely on vegetables were to take no food for a few days, his acrimony would be alkalescent.

IV. We are next to take notice of the *quantity of nutriment* these different foods afford. Nutriment is of two kinds: the first repairs the waste of the solid fibres; the other supplies certain fluids, the chief of which is oil. Now, as animal food is easier converted, and also longer retained in the system, and as it contains a greater proportion of oil, it will afford both kinds of nutriment more copiously than vegetables.

V. Lastly, *As to the different degrees of perspirability of these foods.* This is not yet properly determined. Sanctorius constantly speaks of mutton as the most perspirable of all food, and of vegetables as checking perspiration. This is a consequence of the different stimulus those foods give to the stomach, so that persons who live on vegetables have not their perspiration so suddenly excited. In time of digestion, perspiration is stopped from whatever food, much more so from cooling vegetables. Another reason why vegetables are less perspirable is, because their aqueo-saline juices determine them to go off by urine, while the more perfectly mixed animal food is more equally diffused over the system, and so goes off by perspiration. Hence Sanctorius's accounts may be understood; for vegetable aliment is not longer retained in the body, but mostly takes the course of the kidneys. Both are equally perspirable in this respect, viz. that a person living on either returns once a-day to his usual weight; and if we consider the little nourishment of vegetables, and the great tendency of animal food to corpulency, we must allow that vegetable is more quickly perspired than animal food.

As to the question, Whether man was originally designed for animal or vegetable food, see the article Carnivorous.

With regard to the effects of these foods on men, it must be observed, that there are no persons who live entirely on vegetables. The Pythagoreans themselves ate milk; and those who do so mostly, as these Pythagoreans, are weakly, sickly, and meagre, labour-

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Food. ing under a conſtant diarrhœa and ſeveral other diſeaſes. None of the hardy, robuſt, live on theſe; but chiefly ſuch as gain a livelihood by the exertion of their mental faculties, as (in the Eaſt Indies) factors and brokers; and this method of life is now confined to the hot climates, where vegetable diet, without inconvenience, may be carried to great exceſs. Though it be granted, therefore, that man is intended to live on theſe different foods promiſcuouſly, yet the vegetable ſhould be in very great proportion. Thus the Laplanders are ſaid to live entirely on animal food: but this is contradicted by the beſt accounts; for Linnæus ſays, that beſides milk, which they take four, to obviate the bad effects of animal food, they uſe alſo calamenyanthes, and many other plants, copiouſly. So there is no inſtance of any nation living entirely either on vegetable or animal food, though there are indeed ſome who live particularly on one or other in the greateſt proportion. In the cold countries, *e. g.* the inhabitants live chiefly on animal food, on account of the rigour of the ſeaſon, their ſmaller perſpiration, and little tendency to putrefaction.

Of more importance, however, is the following than the former queſtion, viz. *In what proportion animal and vegetable food ought to be mixed?*

1. *Animal* food certainly gives moſt ſtrength to the ſyſtem. It is a known aphoriſm of Sanctorius, that *pondus addit robur;* which may be explained from the impletion of the blood-veſſels, and giving a proper degree of tenſion for the performance of ſtrong oſcillations. Now animal food not only goes a greater way in ſupplying fluid, but alſo gives the fluid more denſe and elaſtic. The art of giving the utmoſt ſtrength to the ſyſtem is beſt underſtood by thoſe who breed fighting cocks. Theſe people raiſe the cocks to a certain weight, which muſt bear a certain proportion to the other parts of the ſyſtem, and which at the ſame time is ſo nicely proportioned, as that, on loſing a few ounces of it, their ſtrength is very conſiderably impaired. Dr Robinſon of Dublin has obſerved, that the force and weight of the ſyſtem ought to be determined by the largeneſs of the heart, and its proportion to the ſyſtem: for a large heart will give large blood-veſſels, while at the ſame time the viſcera are leſs, particularly the liver; which laſt being increaſed in ſize, a greater quantity of fluid is determined into the cellular texture, and leſs into the ſanguineous ſyſtem. Hence we ſee how animal food gives ſtrength, by filling the ſanguiferous veſſels. What pains we now beſtow on cocks, the ancients did on the athletæ, by proper nouriſhment bringing them to a great degree of ſtrength and agility. It is ſaid that men were at firſt fed on figs, a proof of which we have from their nutritious quality: however, in this reſpect they were ſoon found to fall far ſhort of animal food; and thus we ſee, that men, in ſome meaſure, will work in proportion to the quality of their food. The Engliſh labour more than the Scots; and wherever men are expoſed to hard labour, their food ſhould be animal.—Animal food, although it gives ſtrength, yet loads the body; and Hippocrates long ago obſerved, that the athletic habit, by a ſmall increaſe, was expoſed to the greateſt hazards. Hence it is only proper for bodily labours, and entirely improper for mental exerciſes; for whoever would keep his mind acute and penetrating, will exceed rather on the ſide of vegetable food. Even the body is oppreſſed with animal food; a full meal alwas produces dulneſs, lazineſs, and yawning; and hence the feeding of gameſters, whoſe mind muſt be ready to take advantage, is always performed by avoiding a large quantity of animal food. Farther, With regard to the ſtrength of the body, animal food, in the firſt ſtage of life, is hardly neceſſary to give ſtrength: in manhood, when we are expoſed to active ſcenes, it is more allowable; and even in the decline of life, ſome proportion of it is neceſſary to keep the body in vigour. There are ſome diſeaſes which come on in the decay of life, at leaſt are aggravated by it; among theſe the moſt remarkable is the gout. This, when it is in the ſyſtem, and does not appear with inflammation in the extremities, has pernicious effects there, attacking the lungs, ſtomach, head, &c. Now to determine this to the extremities, a large proportion of animal food is neceſſary, eſpecially as the perſon is commonly incapable of much exerciſe. Food.

Animal food, although it gives ſtrength, is yet of many hazards to the ſyſtem, as it produces plethora and all its conſequences. As a ſtimulus to the ſtomach and to the whole ſyſtem, it excites fever, urges the circulation, and promotes the perſpiration. The ſyſtem, however, by the repetition of theſe ſtimuli, is ſoon worn out; and a man who has early uſed the athletic diet, is either early carried off by inflammatory diſeaſes, or, if he takes exerciſe ſufficient to render that diet ſalutary, ſuch an accumulation is made of putreſcent fluids, as in his after life lays a foundation for the moſt inveterate chronic diſtempers. Therefore it is to be queſtioned, whether we ſhould deſire this high degree of bodily ſtrength, with all the inconveniences and dangers attending it. Thoſe who are chiefly employed in mental reſearches, and not expoſed to too much bodily labour, ſhould always avoid an exceſs of animal food. There is a diſeaſe which ſeems to require animal food, viz. the hyſteric, or hypochondriac; and which appears to be very much a-kin to the gout, affecting the alimentary canal. All people affected with this diſeaſe are much diſpoſed to aceſcency; which ſometimes goes ſo far, that no other vegetable but bread can be taken in, without occaſioning the worſt conſequences. Here then we are obliged to preſcribe an animal diet, even to thoſe of very weak organs; for it generally obviates the ſymptoms. However, ſeveral inſtances of ſcurvy in exceſs have been produced by a long continued uſe of this diet, which it is always unlucky to be obliged to preſcribe; and when it is abſolutely neceſſary to preſcribe, it ſhould be joined with as much of the vegetable as poſſible, and when a cure is performed we ſhould gradually recur to that again.

2. Next, let us conſider the *vegetable* diet. The chief inconveniency of this is difficulty of aſſimilation; which, however, in the vigorous and exerciſed, will not be liable to occur. In warm climates, the aſſimilation of vegetable aliment is more eaſy, ſo that *there* it may be more uſed, and when joined to exerciſe gives a pretty tolerable degree of ſtrength and vigour; and though the general rule be in favour of *animal* diet, for giving ſtrength, yet there are many inſtances of its being remarkably produced from vegetable. Vegetable diet has this advantage, that it whets the appetite, and that we can hardly ſuffer from a full meal of it. Beſides,

Food. the diſorders it is liable to produce in the *primæ viæ*, and its falling ſhort to give ſtrength, there ſeem to be no bad conſequences it can produce in the blood veſſels; for there is no inſtance where its peculiar acrimony was ever carried there, and it is certainly leſs putrefiable than animal food; nor, without the utmoſt indolence, and a ſharp appetite, does it give plethora, or any of its conſequences: ſo that we cannot here but conclude, that a large proportion of vegetable food is uſeful for the generality of mankind. Food.

There is no error in this country more dangerous, or more common, than the neglect of bread: for it is the ſafeſt of vegetable aliments, and the beſt corrector of animal food; and, by a large proportion of this alone, its bad conſequences, when uſed in a hypochondriac ſtate, have been obviated. The French apparently have as much animal food on their tables as the Britiſh; and yet, by a greater uſe of bread and the dried acid fruits, its bad effects are prevented; and therefore bread ſhould be particularly uſed by the Engliſh, as they are ſo voracious of animal food. Vegetable food is not only neceſſary to ſecure health, but long life: and, as we have ſaid, in infancy and youth we ſhould be confined to it moſtly; in manhood, and decay of life, uſe animal food; and, near the end, vetable again.

There is another queſtion much agitated, viz. *What are the effects of variety in food?* Is it neceſſary and allowable, or univerſally hurtful? Variety of a certain kind ſeems neceſſary; as vegetable and animal foods have their mutual advantages, tending to correct each other. Another variety, which is very proper, is that of liquid and ſolid food, which ſhould be ſo managed as to temper each other; and liquid food, eſpecially of the vegetable kind, is too ready to paſs off before it is properly aſſimilated, while ſolid food makes a long ſtay. But this does not properly belong to the queſtion, whether variety of the ſame kind is neceſſary or proper, as in animal foods, beef, fiſh, fowl, &c. It doth not appear that there is any inconvenience ariſing from this mixture or difficulty of aſſimilation, provided a moderate quantity be taken. When any inconvenience does ariſe, it probably proceeds from this, that one of the particular ſubſtances in the mixture, when taken by itſelf would produce the *ſame effects*; and, indeed, it would appear, that this effect is not *heightened* by the mixture, but properly *obviated* by it. There are few exceptions to this, if any, e. g. taking a large proportion of aceſcent ſubſtances with milk. The coldneſs, &c. acidity, flatulency, &c. may appear; and it is poſſible that the coagulum, from the aceſcency of the vegetables, being ſomewhat ſtronger induced, may give occaſion to too long retention in the ſtomach, and to acidity in too great degree. Again, the mixture of fiſh and milk often occaſions inconveniences. The theory of this is difficult, though, from univerſal conſent, it muſt certainly be juſt. Can we ſuppoſe that fiſh gives occaſion to ſuch a coagulum as runnet? If it does ſo, it may produce bad effects. Beſides, fiſhes approach ſomewhat to vegetables, in giving little ſtimulus; and are accuſed of the ſame bad effects as theſe, viz. bringing on the cold fit of fever.

Thus much may be ſaid for variety. But it alſo has its diſadvantages, provoking to gluttony; this, and the art of cookery, making men take in more than they properly can digeſt: and hence, perhaps very juſtly, phyſicians have univerſally almoſt preferred ſimplicity of diet; for, in ſpite of rules, man's eating will only be meaſured by his appetite, and ſatiety is ſooner produced by *one* than by *many* ſubſtances. But this is ſo far from being an argument againſt variety, that it is one for it, as the only way of avoiding a full meal of animal food, and its bad effects, is by preſenting a quantity of vegetables. Another mean of preventing the bad effects of animal food, is to take a large proportion of liquid; and hence the bad effects of animal food are leſs felt in Scotland, on account of their drinking much with it, and uſing broths, which are at once excellent correctors of animal food and preventives of gluttony.

With regard to the difference between ANIMAL FOODS, properly ſo called, the firſt regards their ſolubility, depending on a lax or firm texture of their different kinds.

I. SOLUBILITY of animal food ſeems to deſerve leſs attention than is commonly imagined; for there are many inſtances of perſons of a weak ſtomach incapable of breaking down the texture of vegetables, or even of diſſolving a light pudding, to whom hung beef, or a piece of ham, was very grateful and eaſily digeſted. None of the theories given for the ſolution of animal food in the human ſtomach ſeem to have explained the proceſs ſufficiently. Long ago has been diſcarded the ſuppoſition of an active corroſive menſtruum there; and alſo the doctrine of trituration, for which, indeed, there ſeems no mechaniſm in the human body; and, till lately, phyſicians commonly agreed with Boerhaave in ſuppoſing nothing more to be neceſſary than a watery menſtruum, moderate heat, and frequent agitation. This will account for ſolution in ſome caſes, but not entirely. Let us try to imitate it out of the body with the ſame circumſtances, and in ten times the time in which the food is diſſolved in the ſtomach we ſhall not be able to bring about the ſame changes. Take the coagulated white of an egg, which almoſt every body can eaſily digeſt, and yet no artifice ſhall be able to diſſolve it. Hence, then, we are led to ſeek another cauſe for ſolution, viz. fermentation; a notion, indeed, formerly embraced, but on the introduction of mechanical philoſophy, induſtriouſly baniſhed, with every other ſuppoſition of that proceſs taking place at all in the animal economy.

Many of the ancients imagined this fermentation to be putrefactive. But this we deny, as an acid is produced; though hence the fermentation might be reckoned the vinous, which, however, ſeems always to be morbid. Neither, indeed, is the fermentation purely acetous, but modified by putreſcence; for Pringle has obſerved, that animal matters raiſe and even expede the acetous proceſs. The fermentation, then, in the ſtomach is of a mixed nature, between the acetous and putrefactive, mutually modifying each other; though, indeed, in the inteſtines, ſomewhat of the putrefactive ſeems to take place, as may be obſerved from the ſtate of the feces broke down, and from the little diſpoſition of ſuch ſubſtances to be ſo, which are not liable to the putrefactive proceſs, as the firmer parts of vegetables, &c. Upon this view ſolution ſeems to be extremely eaſy, and thoſe ſubſtances to be moſt eaſily broke down

which

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which are moſt ſubject to putrefaction. See ANATOMY, and *Gastric juice*.

But ſolution alſo depends on other circumſtances, and hence requires a more particular regard.

1. There is a difference of ſolubility with reſpect to the manducation of animal food, for which bread is extremely neceſſary, in order to keep the more ſlippery parts in the mouth till they be properly comminuted. From want of proper manducation perſons are ſubject to eructations; and this more frequently from the firm vegetable foods, as apples, almonds, &c. than from the animal, though, indeed, even from animal food, very tendinous, or ſwallowed in unbroken maſſes, ſuch ſometimes occur. Manducation is ſo much connected with ſolution, that ſome, from imperfectly performing that, are obliged to belch up their food, remanducate it, and ſwallow it again before the ſtomach can diſſolve it, or proper nouriſhment be extracted. Another proof of our regard to ſolubility, is our rejecting the firmer parts of animal food, as bull beef, and generally carnivorous animals.

2. Its effects with regard to ſolubility ſeem alſo to be the foundation of our choice between *fat* and *lean*, *young* and *old meats*. In the *lean* although perhaps a ſingle fibre might be ſufficiently tender, yet theſe, when collected in *faſciculi*, are very firm and compact, and of difficult ſolution; whereas in the *fat* there is a greater number of veſſels, a greater quantity of juice, more interpoſition of cellular ſubſtance, and conſequently more ſolubility. Again, In young animals, there is probably the ſame number of fibres as in the older, but theſe more connected: whereas, in the older, the growth depending on the ſeparation of theſe, and the increaſe of veſſels and cellular ſubſtance, the texture is leſs firm and more ſoluble; which qualities, with regard to the ſtomach, are at that time too increaſed, by the increaſed alkaleſcency of the animal. To this alſo may be referred our choice of caſtrated animals, viz. on account of their diſpoſition to fatten after the operation.

3. It is with a view to the ſolubility, that we make a choice between meats recently killed, and thoſe which have been kept for ſome time. As ſoon as meat is killed, the putrefactive proceſs begins; which commonly we allow to proceed for a little, as that proceſs is the moſt effectual breaker down of animal matters, and a great aſſiſtance to ſolution. The length of time during which meat ought to be kept, is proportioned to the meat's tendency to undergo the putrid fermentation, and the degree of thoſe circumſtances which favour it: Thus, in the torrid zone, where meat cannot be kept above four or five hours, it is uſed much more recent than in theſe northern climates.

4. *Boiled* or *roaſted* meats create a difference of ſolution. By boiling we extract the juices interpoſed between the fibres, approximate them more to each other, and render them of more difficult ſolubility; which is increaſed too by the extraction of the juices, which are much more alkaleſcent than the fibres: but when we want to avoid the ſtimulus of alkaleſcent food, and the quick ſolution, as in ſome caſes of diſeaſe, the roaſted is not to be choſen. Of roaſted meat it may be aſked, which are more proper, thoſe which are moſt or leaſt roaſted? That which is leaſt done is certainly the moſt ſoluble: even raw meats are more ſoluble than dreſſed, as Dr Cullen was informed by a perſon who from neceſſity was obliged, for ſome time, to eat ſuch. But at the ſame time that meats little done are very ſoluble, they are very alkaleſcent; ſo that, wherever we want to avoid alkaleſcency in the *primæ viæ*, the moſt roaſted meats ſhould be choſen. Thoſe who throw away the broths of boiled meat do very improperly; for, beſides their ſupplying a fluid, from their greater alkaleſcency they increaſe the ſolubility of the meat. Here we ſhall obſerve, that pure blood has been thought inſoluble. Undoubtedly it is very nutritious; and though out of the body, like the white of eggs, it ſeems very inſoluble, yet, like that too, in the body it is commonly eaſily digeſted. Moſes very properly forbade it the Iſraelites, as in warm countries it is highly alkaleſcent; and even here, when it was uſed in great quantity, the ſcurvy was more frequent: but to a moderate uſe of it, in theſe climates, no ſuch objection takes place.

5. Solubility is varied from another ſource, viz. viſcidity of the juice of aliment. Young animals, then, appear more ſoluble than old, not only on account of the compaction and firmneſs of texture in the latter, but alſo their greater viſcidity of juice. And nothing is more common, than to be longer oppreſſed from a full meal of veal, than from the ſame quantity of beef, &c. Upon account, too, of their greater viſcidity of juice, are the tendinous and ligamentous parts of animals longer retained than the purely muſcular, as well as on account of their firmneſs of texture. Even fiſhes, whoſe muſcular parts are exceedingly tender, are, on account of their gluey viſcoſity, longer of ſolution in the ſtomach. And eggs, too, which are exceedingly nouriſhing, have the ſame effect, and cannot be taken in great quantity: For the ſtomach is peculiarly ſenſible to gelatinous ſubſtances; and by this means has nature perhaps taught us, as it were by a ſort of inſtinct, to limit ourſelves in the quantity of ſuch nutritive ſubſtances.

6. With regard to ſolution, we muſt take in the oils of animal food; which, when tolerably pure, are the leaſt putreſcent part of it, and, by diminiſhing the coheſion of the fibres, render them more ſoluble. On this laſt account is the lean of fat meat more eaſily diſſolved than other lean. But when the meat is expoſed to much heat, this oil is ſeparated, leaving the ſolid parts leſs eaſily ſoluble, and becoming itſelf empyreumatic, ranceſcent, and of difficult mixture in the ſtomach. Fried meats, from the reaſons now given, and baked meats, for the ſame, as well as for the tenacity of the paſte, are preparations which diminiſh the ſolubility of the food. From what has been ſaid, the preparation of food by fattening it, and keeping it for ſome time after being killed, although it may adminiſter to gluttony, will yet, it muſt be confeſſed, increaſe the ſolution of the food.

II. The ſecond difference of animal food is with regard to ALKALESCENCY.

Of this we have taken a little notice already under the head of *Solubility*.

1. From their too great alkaleſcency we commonly avoid the carnivorous animals, and the *feræ*; and chooſe rather the granivorous. Some birds, indeed, which live on inſects, are admitted into our food; but

Food. no man, without *nauſea*, can live upon theſe alone for any length of time. Fiſhes, too, are an exception to this rule, living almoſt univerſally on each other. But in theſe the alkaleſcency does not proceed ſo far; whether from the viſcidity of their juice, their want of heat, or ſome peculiarity in their economy, is not eaſy to determine.

2. Alkaleſcency is determined by difference of age. The older animals are always more alkaleſcent than the young, from their continual progreſs to putrefaction. Homberg always found, in his endeavours to extract an acid from human blood, that more was obtained from the young than from the old animals.

3. A third circumſtance which varies the alkaleſcency of the food, is the wildneſs or tameneſs of the animal; and this again ſeems to depend on its exerciſe. Dr Cullen knew a gentleman who was fond of cats for food; but he always uſed to feed them on vegetable food, and kept them from exerciſe; and in the ſame manner did the Romans rear up their rats, when intended for food. In the ſame way the fleſh of the partridge and the hen ſeems to be much the ſame; only, from its being more on the wing, the one is more alkaleſcent than the other. Again, Tame animals are commonly uſed without their blood; whereas the wild are commonly killed in their blood, and upon that account, as well as their greater exerciſe, are more alkaleſcent.

4. The alkaleſcency of food may be determined from the quantity of volatile ſalt it affords. The older the meat is, it is found to give the greater proportion of volatile ſalt.

5. The alkaleſcency of aliment may alſo, in ſome meaſure, be determined from its colour, the younger animals being whiter and leſs alkaleſcent. We alſo take a mark from the colour of the gravy poured out, according to the redneſs of the juices judging of the animal's alkaleſcency.

6. The reliſh of food is found to depend much on its alkaleſcency, as does alſo the ſtimulus it gives and the fever it produces in the ſyſtem. Theſe effects are alſo complicated with the viſcidity of the food, by which means it is longer detained in the ſtomach, and the want of alkaleſcency ſupplied.

Having mentioned animal food as differing in ſolubility and alkaleſcency, which often go together in the ſame ſubject, we come to the third difference, viz.

III. QUANTITY of Nutriment. Which is either abſolute or relative: abſolute with reſpect to the quantity it really contains, ſufficient powers being given to extract it; relative, with reſpect to the aſſimilatory powers of thoſe who uſe it. The abſolute nutriment is of ſome conſequence; but the relative, in the robuſt and healthy, and except in caſes of extraordinary weakneſs, may, without much inconvenience, be diſregarded. In another caſe is the quantity of nourithment relative, viz. with regard to its *perſpirability*; for if the food is ſoon carried off by the excretions, it is the ſame thing as if it contained a leſs proportion of nourithment. For, giving more fluid, that which is longer retained affords moſt: and, for the repair of the ſolids, that retention alſo is of advantage. Now, gelatinous ſubſtances are long retained; and beſides, are themſelves animal ſubſtances diſſolved: ſo that, both abſolutely and relatively, ſuch ſubſtances are nutritious. Of this kind are eggs, ſhell fiſh, &c. In adults, though it is diſputed whether their ſolids need any repair, yet at any rate, at this period, fluid is more required; for this purpoſe the alkaleſcent foods are moſt proper, being moſt eaſily diſſolved. They are, at the ſame time, the moſt perſpirable; on one hand that alkaleſcency leading to diſeaſe, while on the other their perſpirability obviates it. Adults, therefore, as writers juſtly obſerve, are better nourithed on the alkaleſcent; the young and growing, on gelatinous foods. All this leads to a compariſon of young and old meats; the firſt being more gelatinous, and the laſt more alkaleſcent. This however, by experience, is not yet properly aſcertained. Mr Geoffroy is the only perſon who has been taken up with the analyſis of foods. See *Memoires de l'Academie*, Pan. 1731 & 1732. His attempt was certainly laudable, and in ſome reſpects uſefully performed; but, in general, his experiments were not ſufficiently repeated, nor are indeed ſufficiently accurate. He has not been on his guard againſt the various circumſtances which affect meats; the cow-kind liking a moiſt ſucculent herbage, which is not to be got in warm climates; while the ſheep are fond of dry food, and thrive beſt there. Again, Some of his experiments ſeem contradictory. He ſays, that veal gives more ſolution than beef, while lamb gives leſs than mutton, which is much to be doubted. If both he and Sanctorius had examined Engliſh beef, the reſult probably would have been very different as to its perſpirability, &c. Beſides, Mr Geoffroy has only analyzed beef and veal when raw; has made no proper circumſtantial compariſons between quadrupeds and birds; and has examined theſe laſt along with their bones, and not their muſcles, &c. by themſelves, as he ought to have done, &c. If a ſet of experiments of this kind were properly and accurately performed, they might be of great uſe; but at preſent, for the purpoſe of determining our preſent ſubject, we muſt have recourſe to our alkaleſcency, ſolubility, &c.

IV. The fourth difference of animal food is, *The NATURE of the FLUIDS they afford*. The whole of this will be underſtood from what has been ſaid on alkaleſcency; the fluid produced being more or leſs denſe and ſtimulating, in proportion as that prevails.

V. The fifth difference of animal foods is with reſpect to their

PERSPIRABILITY. The ſum of what can be ſaid on this matter is this, that ſuch foods as promote an accumulation of fluid in our veſſels and diſpoſe to plethora, are the leaſt perſpirable, and commonly give moſt ſtrength; that the more alkaleſcent foods are the moſt perſpirable, though the viſcid and leſs alkaleſcent may attain the ſame property by long retention in the ſyſtem. The authors on perſpirability have determined the perſpiration of foods as imperfectly as Mr Geoffroy has done the ſolubility, and in a few caſes only. We muſt not lay hold on what Sanctorius has ſaid on the perſpirability of mutton, becauſe he has not examined in the ſame way other meats in their perfect ſtate; far leſs on what Keil ſays of oysters, as he himſelf was a valetudinarian, and conſequently an unfit ſubject for ſuch experiments, and probably of a peculiar temperament.

As to the effects of FOOD on the MIND, we have already hinted at them above. It is plain, that deli-

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cacy of feeling, livelineſs of imagination, quickneſs of apprehenſion, and acuteneſs of judgment, more frequently accompany a weak ſtate of the body. True it is indeed, that the ſame ſtate is liable to timidity, fluctuation and doubt; while the ſtrong have that ſteadineſs of judgment, and firmneſs of purpoſe, which are proper for the higher and more active ſcenes of life. The moſt valuable ſtate of the mind, however, appears to reſide in ſomewhat leſs firmneſs and vigour of body. Vegetable aliment, as never over-diſtending the veſſels or loading the ſyſtem, never interrupts the ſtronger motions of the mind; while the heat, fulneſs, and weight, of animal food, are an enemy to its vigorous efforts. Temperance, then, does not ſo much conſiſt in the quantity, for that always will be regulated by our appetite, as in the quality, viz. a large proportion of vegetable aliment.

A conſiderable change has now taken place in the articles made uſe of as food by the ancients, by ſubſtituting, inſtead of what were then uſed, particularly of the vegetable kind, a number of more bland, agreeable, and nutritive juices. The acorns and nuts of the primitive times have given way to a variety of ſweeter farinaceous ſeeds and roots. To the malvaceous tribe of plants ſo much uſed by the Greeks and Romans, hath ſucceeded the more grateful ſpinach: and to the blite, the garden orach. The rough borage is ſupplanted by the aceſcent ſorrel: and aſparagus has baniſhed a number of roots recorded by the Roman writers under the name of *bulbs*; but Linnæus is of opinion, that the parſnip has undeſervedly uſurped the place of the ſkirret. The bean of the ancients, improperly ſo called, being the roots as well as other parts of the *nymphæa nelumbo*, or Indian water-lily, is ſuperſeded by the kidney bean. The garden rocket, eaten with and as an antidote againſt the chilling qualities of the lettuce, is baniſhed by the more agreeable creſs and tarragon; the apium by the meliorated celery; the pompion, and others of the cucurbitaceous tribe, by the melon; and the ſumach berries, by the fragrant nutmeg. The ſilphium, or ſuccus Cyrenaicus, which the Romans purchaſed from Perſia and India at a great price, and is thought by ſome to have been the aſafœtida of the preſent time, is no longer uſed in preference to the alliaceous tribe.

To turn from the vegetable to ſome of the animal ſubſtitutes, we may mention the carp among fiſhes as having excluded a great number held in high eſtimation among the Romans; the change of oil for butter; of honey for ſugar; of mulſa, or liquors made of wine, water, and honey, for the wines of modern times; and that of the ancient zythus for the preſent improved malt liquors; not to mention alſo the *Callida* of the Roman taverns, analogous to our tea and coffee.

Food of Plants. See AGRICULTURE *Index*.

FOOL, according to Mr Locke, is a perſon who makes falſe concluſions from right principles; whereas a madman, on the contrary, draws right concluſions from wrong principles. See FOLLY.

Fool-Stones. See ORCHIS, BOTANY *Index*.

FOOSHT, an iſland in the Red ſea; ſituated, according to the obſervations of Mr Bruce, in N. Lat. 13° 59′ 43″. It is deſcribed by him as about five miles in length from north to ſouth, though only *nine* in circumference. It is low and ſandy in the ſouthern part, but the north riſes in a black hill of inconſiderable height. It is covered with a kind of bent graſs, which never ariſes at any great length by reaſon of want of rain and the conſtant browzing of the goats. There are great appearances of the black hill having once been a volcano; and near the north cape the ground ſounds hollow like the Solfaterra in Italy. There are a vaſt number of beautiful fiſh met with upon the coaſts, but few fit for eating, and our traveller obſerved, that the moſt beautiful were the moſt noxious when eaten; none indeed, being ſalutary food excepting thoſe which reſembled the fiſh of the northern ſeas. There are many beautiful ſhell-fiſh, as the concha veneris, of ſeveral colours and ſizes; ſea urchins, &c. Sponges are likewiſe found all along the coaſt. There are alſo pearls, but neither large nor of a good-water; in conſequence of which they ſell at no great price. They are produced by a ſpecies of bivalve ſhells. Several large ſhells, from the fiſh named *biſſer*, are met with upon ſtones of ten or twelve tons weight along the coaſt. They are turned upon their faces and ſunk into the ſtones, as into a paſte, the ſtone being raiſed all about them in ſuch a manner as to cover the edge of the ſhell; "a proof (ſays Mr Bruce) that this ſtone muſt ſome time lately have been ſoft or liquefied: for had it been long ago, the ſun and air would have worn the ſurface of the ſhell; but it ſeems perfectly entire, and is ſet in that hard brown rock as the ſtone of a ring is in a golden chaſing."—The water in this iſland is very good.

Fooſht, Foot.

The inhabitants of Fooſht are poor fiſhermen of a ſwarthy colour; going naked, excepting only a rag about their waiſt. They have no bread but what they procure in exchange for the fiſh they catch. What they barter in this manner is called *ſeajan*. But beſides this they catch another ſpecies, which is flat, with a long tail, and the ſkin made uſe of for ſhagreen, of which the handles of knives and ſwords are made. There is a ſmall town on the iſland, conſiſting of about 30 huts, built with faggots of bent graſs or ſpartum, ſupported by a few ſticks, and thatched with graſs of the ſame kind of which they are built.

FOOT, a part of the body of moſt animals whereon they ſtand, walk, &c. See ANATOMY.

FOOT, in the Latin and Greek poetry, a metre or meaſure, compoſed of a certain number of long and ſhort ſyllables.

Theſe feet are commonly reckoned 28: of which ſome are ſimple, as conſiſting of two or three ſyllables, and therefore called *diſſyllabic* or *triſyllabic feet*; others are compound, conſiſting of four ſyllables, and are therefore called *tetraſyllabic feet*.

The diſſyllabic feet are four in number, viz. the pyrrhichius, ſpondeus, iambus, and trocheus. See PYRRHICHIUS, &c.

The triſyllabic feet are eight in number, viz. the dactylus, anapæſtus, tribrachys, moloſſus, amphibrachys, amphimacer, bacchius, and antibacchius. See DACTYL, &c.

The tetraſyllabic are in number 16, viz. the proceleuſmaticus, diſpondeus, choriambus, antiſpaſtus, diiambus, dichoreus, ionicus a majore, ionicus a minore, epitritus primus, epitritus ſecundus, epitritus tertius, epitritus

Foot, Foote.

epitritus quartus, pæon primus, pæon ſecundus, pæon tertius, and pæon quartus. See PROCELEUSMATICUS, &c.

FOOT is alſo a long meaſure conſiſting of 12 inches. Geometricians divide the foot into 10 digits, and the digit into 10 lines.

Foot-Halt, the name of a diſorder peculiar to ſheep. It is occaſioned by an inſect, which, when it comes to a certain maturity, reſembles a worm of two, three, or four inches in length. See FARRIERY *Index*.

Foot Square, is the ſame meaſure both in breadth and length, containing 144 ſquare or ſuperficial inches.

Cubic or *Solid Foot*, is the ſame meaſure in all the three dimenſions, length, breadth, and depth or thickneſs, containing 1728 cubic inches.

Foot of a Horſe, in the manege, the extremity of the leg, from the coronet to the lower part of the hoof.

Foot Level, among artificers, an inſtrument that ſerves as a foot rule, a ſquare, and a level. See LEVEL, RULE, and SQUARE.

FOOTE, SAMUEL, Eſq. the modern Ariſtophanes, was born at Truro, in Cornwall; and was deſcended from a very ancient family. His father was member of parliament for Tiverton, in Devonſhire, and enjoyed the poſt of commiſſioner of the prize office and fine-contract. His mother was heireſs of the Dinely and Goodere families. In conſequence of a fatal miſunderſtanding between her two brothers, Sir John Dinely Goodere, Bart. and Samuel Goodere, Eſq. captain of his majeſty's ſhip the Ruby, which ended in the death of both, a conſiderable part of the Goodere eſtate, which was better than 5000l. per annum, deſcended to Mr Foote.

He was educated at Worceſter college, Oxford, which owed its foundation to Sir Thomas Cookes Winford, Bart. a ſecond couſin of our author's. On leaving the univerſity, he commenced ſtudent of law in the Temple; but as the dryneſs of this ſtudy did not ſuit the livelineſs of his genius, he ſoon relinquiſhed it. He married a young lady of a good family and ſome fortune; but their tempers not agreeing, a perfect harmony did not long ſubſiſt between them. He now launched into all the faſhionable foibles of the age, gaming not excepted, and in a few years ſpent his whole fortune. His neceſſities led him to the ſtage, and he made his firſt appearance in the character of Othello. He next performed Fondlewife with much more applauſe; and this, indeed, was ever after one of his capital parts. He attempted Lord Foppington likewiſe, but prudently gave it up. But as Mr Foote was never a capital actor in the plays of others, his ſalary was very unequal to his gay and extravagant turn; and he contracted debts which forced him to take refuge within the verge of the court. On this occaſion, he relieved his neceſſities by the following ſtratagem. Sir Fr—s D—l—l had long been his intimate friend, and had diſſipated his fortune by ſimilar extravagance. Lady N-ſſ-u P—let, who was likewiſe an intimate acquaintance of Foote's, and who was exceedingly rich, was fortunately at that time bent upon a matrimonial ſcheme. Foote ſtrongly recommended to her to conſult upon this momentous affair the conjurer in the Old Bailey, whom he repreſented as a man of ſurpriſing ſkill and penetration. He employed an acquaintance of his own to perſonate the conjurer; who depicted Sir Fr—s D—l—l at full length; deſcribed the time when, the place where, and the dreſs in which ſhe would ſee him. The lady was ſo ſtruck with the coincidence of every circumſtance, that ſhe married D—l—l in a few days. For this ſervice Sir Francis ſettled an annuity upon Foote; and this enabled him once more to emerge from obſcurity.

In 1747 he opened the little theatre in the Hay market, taking upon himſelf the double character of author and performer; and appeared in a dramatic piece of his own compoſing, called the *Diverſions of the Morning*. This piece conſiſted of nothing more than the exhibition of ſeveral characters well known in real life; whoſe manner of converſation and expreſſion this author very happily hit off in the diction of his drama, and ſtill more happily repreſented on the ſtage, by an exact and moſt amazing imitation, not only of the manner and tone of voice, but even of the very perſons, of thoſe whom he intended to take off. In this performance, a certain phyſician, Dr L—n, well known for the oddity and ſingularity of his appearance and converſation, and the celebrated Chevalier Taylor, who was at that time in the height of his popularity, were made objects of Foote's ridicule; the latter, indeed very deſervedly; and, in the concluding part of his ſpeech, under the character of a theatrical director, Mr Foote took off, with great humour and accuracy, the ſeveral ſtyles of acting of every principal performer on the Engliſh ſtage. This performance at firſt met with ſome oppoſition from the civil magiſtrates of Weſtminſter, under the ſanction of the act of parliament for limiting the number of playhouſes, as well as from the jealouſy of one of the managers of Drury-lane playhouſe; but the author being patronized by many of the principal nobility, and other perſons of diſtinction, this oppoſition was over-ruled: and having altered the title of his performance, Mr Foote proceeded, without further moleſtation, to give *Tea in a Morning* to his friends, and repreſented it through a run of 40 mornings to crowded and ſplendid audiences.—The enſuing ſeaſon he produced another piece of the ſame kind, which he called *An Auction of Pictures*. In this performance he introduced ſeveral new and popular characters; particularly Sir Thomas de Veil, then the acting juſtice of peace for Weſtminſter, Mr Cock the celebrated auctioneer, and the equally famous Orator Henley. This piece alſo had a very great run.—His *Knights*, which was the produce of the enſuing ſeaſon, was a performance of ſomewhat more dramatic regularity: but ſtill, although his plot and characters ſeemed leſs immediately perſonal, it was apparent that he kept ſome particular real perſons ſtrongly in his eye in the performance; and the town took upon themſelves to fix them where the reſemblance appeared to be the moſt ſtriking. Thus Mr Foote continued from time to time to ſelect, for the entertainment of the public, ſuch characters, as well general as individual, as ſeemed moſt likely to engage their attention. His dramatic pieces, excluſive of the interlude called *Piety in Pattens*, are as follow: Taſte, the Knights, The Author, The Engliſhman in Paris, The Engliſhman returned from Paris, The Mayor of Garrat, The Liar, The Patron, The Minor, The Orators, The

Foote. Commiſſary, The Devil upon Two Sticks, The Lame Lover, The Maid of Bath, The Nabob, The Cozeners, The Capuchin, The Bankrupt, and an unfiniſhed comedy called The Slanderer. All theſe works are only to be ranked among the *petites pieces* of the theatre. In the execution they are ſomewhat looſe, negligent, and unfiniſhed; the plots are often irregular, and the cataſtrophes not always concluſive: but, with all theſe deficiencies, they contain more ſtrength of character, more ſtrokes of keen ſatire, and more touches of temporary humour, than are to be found in the writings of any other modern dramatiſt. Even the language ſpoken by his characters, incorrect as it may ſometimes ſeem, will on a cloſer examination be found entirely dramatical; as it abounds with thoſe natural minutiæ of expreſſion which frequently form the very baſis of character, and which render it the trueſt mirror of the converſation of the times in which he wrote.

In the year 1766, being on a party of pleaſure with the late duke of York, Lord Mexborough, and Sir Francis Delaval, Mr Foote had the misfortune to break his leg, by a fall from his horſe; in conſequence of which, he was compelled to undergo an amputation. This accident ſo ſenſibly affected the duke, that he made a point of obtaining for Mr Foote a patent for life; whereby he was allowed to perform, at the little theatre in the Haymarket, from the 15th of May to the 15th of September every year.

He now became a greater favourite of the town than ever: his very laughable pieces, with his more laughable performance, conſtantly filled his houſe; and his receipts were ſome ſeaſons almoſt incredible. Parſimony was never a vice to be aſcribed to Mr Foote; his hoſpitality and generoſity were ever conſpicuous; he was viſited by the firſt nobility, and he was ſometimes honoured even by royal gueſts.

The attack made upon his character by one of his domeſtics, whom he had diſmiſſed for miſbehaviour, is too well known to be particularized here. Suffice it to ſay, he was honourably acquitted of that charge: but it is believed by ſome, that the ſhock which he received from it accelerated his death; others pretend, that his literary altercation with a certain *then* ducheſs, or rather her agents, much affected him, and that from that time his health declined. It is probable, however, that his natural volatility of ſpirits could ſcarcely fail to ſupport him againſt all impreſſions from either of theſe quarters.

Mr Foote, finding his health decline, entered into an agreement with Mr Colman, for his patent of the theatre; according to which, he was to receive from Mr Colman, 1600l. per annum, beſides a ſtipulated ſum whenever he choſe to perform. Mr Foote made his appearance two or three times in ſome of the moſt admired characters; but being ſuddenly affected with a paralytic ſtroke one night whilſt upon the ſtage, he was compelled to retire. He was adviſed to bathe; and accordingly repaired to Brighthelmſtone, where he apparently recovered his former health and ſpirits, and was what is called the *fiddle of the company* who reſorted to that agreeable place of amuſement. A few weeks before his death, he returned to London; but, by the advice of his phyſicians, ſet out with an intention to ſpend the winter at Paris and in the ſouth of France. He had got no farther than Dover, when he was ſuddenly attacked by another ſtroke of the palſy, which in a few hours terminated his exiſtence. He died on the 21ſt of October 1777, in the 56th year of his age, and was privately interred in the cloiſters of Weſtminſter abbey. Fop ‖ Force.

FOP, probably derived from the *vappa* of Horace, applied in the firſt ſatire of his firſt book to the wild and extravagant Nævius, is uſed among us to denote a perſon who cultivates a regard to adventitious ornament and beauty to exceſs.

FORAMEN, in *Anatomy*, a name given to ſeveral apertures or perforations in divers parts of the body; as, 1. The external and internal foramina of the cranium or ſkull. 2. The foramina in the upper and lower jaw. 3. Foramen lachrymale. 4. Foramen membranæ tympani.

Foramen Ovale, an oval aperture or paſſage through the heart of a fœtus, which cloſes up after birth. It ariſes from the coronal vein, near the right auricle, and paſſes directly into the left auricle of the heart, ſerving for the circulation of the blood in the fœtus, till ſuch time as the infant breathes, and the lungs are open: in this the fœtus differs from the adult; although almoſt all anatomiſts, Mr Cheſelden excepted, aſſure us, that the foramen ovale has ſometimes been found in adults. See Foetus.

FORBES, Duncan, Eſq. of Culloden, lord preſiden of the court of ſeſſion in Scotland, was born in the year 1685. In his early life, he was brought up in a family remarkable for hoſpitality; which, perhaps, led him afterwards to a freer indulgence in ſocial pleaſures. His natural diſpoſition inclined him to the army: but, as he ſoon diſcovered a ſuperior genius, by the advice of his friends he applied himſelf to letters. He directed his ſtudies particularly to the civil law; in which he made a quick progreſs, and in 1709 was admitted an advocate. From 1722 to 1737, he repreſented in parliament the boroughs of Inverneſs, Fortroſe, Nairn, and Forres. In 1725, he was made king's advocate; and lord preſident of the court of ſeſſion in 1737. In the rebellions which broke out in Scotland in 1715 and 1745 he eſpouſed the royal cauſe; but with ſo much prudence and moderation did he conduct himſelf at this delicate conjuncture, that not a whiſper was at any time heard to his prejudice. The glory he acquired in advancing the proſperity of his country, and in contributing to re-eſtabliſh peace and order, was the only reward of his ſervices. He had even impaired, and almoſt ruined, his private fortune in the cauſe of the public: but government did not make him the ſmalleſt recompenſe. The miniſter, with a meanneſs for which it is difficult to account, deſired to have a ſtate of his diſburſements. Shocked at the incivility and rudeneſs of this treatment, he left the miniſter without making any reply. Throughout the whole courſe of his life he had a lively ſenſe of religion, without the leaſt taint of ſuperſtition; and his charity was extended to every ſect and denomination of religioniſts indiſcriminately. He was well verſed in the Hebrew language; and wrote in a flowing and oratorial ſtyle, concerning religion natural and revealed, ſome important diſcoveries in theology and philoſophy, and concerning the ſources of incredulity. He died in 1747, in the 62d year of his age; and his works have ſince been publiſhed in two volumes octavo.

FORCE, in *Philoſophy*, denotes the cauſe of the change

Force. change in the ſtate of a body, when, being at reſt, it begins to move, or has a motion which is either not uniform or not direct. While a body remains in the ſame ſtate, either of reſt or of uniform and rectilinear motion, the cauſe of its remaining in ſuch a ſtate is in the nature of the body, and it cannot be ſaid that any extrinſic force has acted on it. This internal cauſe or principle is called *inertia*.

Mechanical forces may be reduced to two ſorts: one of a body at reſt, the other of a body in motion.

The force of a body at reſt, is that which we conceive to be in a body lying ſtill on a table, or hanging by a rope, or ſupported by a ſpring, &c. and this is called by the names of *preſſure*, *tenſion*, *force*, or *vis mortua*, *ſolicitatio*, *conatus movendi*, *conamen*, &c. To this claſs alſo of forces we muſt refer centripetal and centrifugal forces, though they reſide in a body in motion; becauſe theſe forces are homogeneous to weights, preſſures, or tenſions of any kind.

The force of a body in motion is a power reſiding in that body ſo long as it continues its motion; by means of which it is able to remove obſtacles lying in its way; to leſſen, deſtroy, or overcome the force of any other moving body which meets it in an oppoſite direction; or to ſurmount any dead preſſure or reſiſtance, as tenſity, gravity, friction, &c. for ſome time; but which will be leſſened or deſtroyed by ſuch reſiſtance as leſſens or deſtroys the motion of the body. This is called *moving force*, *vis motrix*, and by ſome late writers *vis viva*, to diſtinguiſh it from the *vis mortua* ſpoken of before; and by theſe appellations, however different, the ſame thing is underſtood by all mathematicians; namely, that power of diſplacing, of withſtanding oppoſite moving forces, or of overcoming any dead reſiſtance, which reſides in a moving body, and which, in whole or in part, continues to accompany it, ſo long as the body moves. See MECHANICS.

We have ſeveral curious as well as uſeful obſervations in Deſaguliers's Experimental Philoſophy, concerning the comparative forces of men and horſes, and the beſt way of applying them. A horſe draws with the greateſt advantage when the line of direction is level with his breaſt; in ſuch a ſituation, he is able to draw 200lb. eight hours a-day, walking about two miles and a half an hour. And if the ſame horſe is made to draw 240lb. he can work but ſix hours a-day, and cannot go quite ſo faſt. On a carriage, indeed where friction alone is to be overcome, a middling horſe will draw 1000lb. But the beſt way to try a horſe's force, is by making him draw up out of a well, over a ſingle pulley or roller; and, in ſuch a caſe, one horſe with another will draw 200lb. as already obſerved.

Five men are found to be equal in ſtrength to one horſe, and can, with as much eaſe, puſh round the horizontal beam of a mill, in a walk 40 feet wide; whereas three men will do it in a walk only 19 feet wide.

The worſt way of applying the force of a horſe, is to make him carry or draw up hill: for if the hill be ſteep, three men will do more than a horſe, each man climbing up faſter with a burden of 100lb. weight, than a horſe that is loaded with 300lb.; a difference which is owing to the poſition of the parts of the human body being better adapted to climb than thoſe of a horſe. Force. Forcible.

On the other hand, the beſt way of applying the force of a horſe, is in a horizontal direction, wherein a man can exert leaſt force; thus a man weighing 140lb. and drawing a boat along by means of a rope coming over his ſhoulders, cannot draw above 27lb. or exert above one ſeventh part of the force of a horſe employed to the ſame purpoſe.

The very beſt and moſt effectual poſture in a man, is that of rowing, in which he not only acts with more muſcles at once for overcoming the reſiſtance, than in any other poſition; but as he pulls backward, the weight of his body aſſiſts by way of lever. See Deſaguliers, Exp. Phil. vol. i. p. 241. where we have ſeveral other obſervations relative to force acquired by certain poſitions of the body, from which that author accounts for moſt feats of ſtrength and activity. See alſo a *Memoire* on this ſubject by M. de la Hire, in Mem. Roy. Acad. Sc. 1629: or in Deſaguliers, Exp. &c. 267, &c. who has publiſhed a tranſlation of part of it, with remarks.

Citizen Regnier has invented an inſtrument for aſcertaining the relative ſtrength of men and animals, for an account of which, ſee DYNAMOMETER; and for a fuller deſcription of the apparatus, the reader may conſult the original paper on the ſubject in *Jour. de l'Ecole Polytech.* vol. ii. or the tranſlation in Phil. Mag. vol. i.

FORCE, in *Law*, ſignifies any unlawful violence offered to things or perſons, and is divided into ſimple and compound. *Simple force* is what is ſo committed, that it has no other crime attending it: as where a perſon by force enters on another's poſſeſſion, without committing any other unlawful act. *Compound force*, is where ſome other violence is committed, with ſuch an act which of itſelf alone is criminal; as if one enters by force into another's houſe, and there kills a perſon, or raviſhes a woman. There is likewiſe a force implied in law, as in every treſpaſs, reſcue, or diſſeiſin, and an actual force with weapons, number of perſons, &c.—Any perſon may lawfully enter a tavern, inn, or victualling houſe; ſo may a landlord his tenant's houſe to view repairs, &c. But if, in theſe caſes the perſon that enters commits any violence or force, the law will intend that he entered for that purpoſe.

FORCEPS, in *Surgery*, &c. a pair of ſciſſars for cutting off, or dividing, the fleſhy membranous parts of the body, as occaſion requires. See SURGERY.

FORCER, in *Mechanics*, is properly a piſton without a valve. For, by drawing up ſuch a piſton, the air is drawn up, and the water follows; then puſhing the piſton down again, the water, being prevented from deſcending by the lower valve, is forced up to any height above, by means of a ſide branch between the two.

FORCIBLE ENTRY, is a violent and actual entry into houſes or lands; and a forcible detainer, is where one by violence withholds the poſſeſſion of lands, &c. ſo that the perſon who has a right of entry is barred, or hindered, therefrom.

At common law, any perſon that had a right to enter into lands, &c. might retain poſſeſſion of it by force. But this liberty being abuſed, to the breach of the peace, it was therefore found neceſſary that the ſame ſhould be reſtrained. Though, at this day, he who

Forcible. who is wrongfully diſpoſſeſſed of goods may by force retake them. By ſtatute, no perſons ſhall make an entry on any lands or tenements, except where it is given by law, and in a peaceable manner, even though they have title of entry, on pain of impriſonment: and where a forcible entry is committed, juſtices of peace are authorized to view the place, and inquire of the force by a jury, ſummoned by the ſheriff of the county; and they may cauſe the tenements, &c. to be reſtored, and impriſon the offenders till they pay a fine. Likewiſe a writ of forcible entry lies, where a perſon ſeiſed of freehold, is by force put out thereof.

Forcible Marriage, of a woman of eſtate, is felony. For by the ſtatute 3 H. VII. c. 2. it is enacted, "That if any perſons ſhall take away any woman having lands or goods, or that is heir apparent to her anceſtor, by force, and againſt her will, and *marry* or *defile* her; the takers, procurers, abettors, and receivers, of the woman taken away againſt her will, and knowing the ſame, ſhall be deemed principal felons; but as to procurers and acceſſories before the fact, they are to be excluded the benefit of clergy, by 39 Elizabeth c. 9. The indictment on the ſtatute H. VII. is expreſsly to ſet forth, that the woman taken away had lands or goods, or was heir apparent; and alſo that ſhe was married or defiled, becauſe no other caſe is within the ſtatute; and it ought to allege that the taking was for lucre. It is no excuſe that the woman at firſt was taken away with her conſent: for if ſhe afterwards refuſe to continue with the offender, and be forced againſt her will, ſhe may from that time properly be ſaid to be taken againſt her will; and it is not material whether a woman ſo taken away be at laſt married or defiled with her own conſent or not, if ſhe were under force at the time; the offender being in both caſes equally within the words of the act.

Thoſe perſons who, after the fact, receive the offender, are but acceſſories after the offence, according to the rules of common law; and thoſe that are only privy to the damage, but not parties to the forcible taking away, are not within the act, H. P. C. 119. A man may be indicted for taking away a woman by force in another country; for the continuing of the force in any country, amounts to a forcible taking there. *Ibid.* Taking away any woman-child under the age of 16 years and unmarried, out of the cuſtody and without the conſent of the father or guardian, &c. the offender ſhall ſuffer fine and impriſonment; and if the woman agrees to any contract of matrimony with ſuch perſon, ſhe ſhall forfeit her eſtate during life, to the next of kin, to whom the inheritance ſhould deſcend, &c. ſtat. 4 & 5. P. & M. c. 8. This is a force againſt the parents: and an information will lie for ſeducing a young man or woman from their parents, againſt their conſents, in order to marry them, &c. See Marriage. Forcing || Fordwich.

FORCING, in *Gardening*, a method of producing ripe fruits from trees before their natural ſeaſon. See Gardening *Index*.

Forcing, in the wine trade, a term uſed by the wine coopers for the fining down wines, and rendering them fit for immediate draught. The principal inconvenience of the common way of fining down the white wines with iſinglaſs, and the red with whites of eggs, is the ſlowneſs of the operation; theſe ingredients not performing their office in leſs than a week, or ſometimes a fortnight, according as the weather proves favourable, cloudy or clear, windy or calm: this appears to be matter of conſtant obſervation. But the wine merchant frequently requires a method that ſhall, with certainty, make the wines fit for taſting in a few hours. A method of this kind there is, but it is kept in a few hands a valuable ſecret. Perhaps it depends upon a prudent uſe of a tartarized ſpirit of wine, and the common forcing, as occaſion is, along with gypſum, as the principal; all which are to be well ſtirred about in the wine, for half an hour before it is ſuffered to reſt.

FORDOUN, John of, the father of Scottiſh hiſtory, flouriſhed in the reign of Alexander III. towards the end of the 13th century. But of his life there is nothing known with certainty, though there was not a monaſtery that poſſeſſed not copies of his work. The firſt five books of the hiſtory which bears his name were written by him: the reſt were fabricated from materials left by him, and from new collections by different perſons. A manuſcript in vellum of this hiſtorian is in the library of the univerſity of Edinburgh.

FORDWICH, a town of Kent, called in Doomſday Book "the little borough of Fordwich," is a member of the port of Sandwich, and was anciently incorporated by the ſtyle of the barons of the town of Fordwich, but more lately by the name of the mayor, jurats, and commonalty, who enjoy the ſame privileges as the cinque ports. This place is famous for excellent trouts in its river Stour.

END OF THE EIGHTH VOLUME.

ERRATA IN FLUXIONS.

Page.	Col.	Line.	
700	1	27	for *Mauclaurin* read *Maclaurin*.
706	1	22	for $u=p$, read $u=p\dot{x}$.
—	2	12	for ^3x, read x^3.
708	2	8	for $u\,v$, read u, v.
—	—	37	insert $p\,p'\,h^2$ below $u\,q\,h^2$.
—	—	38	for $(v\,q'+w\,q)h^2$, read $(v\,q'+p\,p'+w\,q)h^2$.
710	2	12	for $a=$, read $u=$.
713	1	1	for *function*, read *fraction*.
714	1	32	prefix the ſign + to the line.
715	1	5	for $(4l-a^2)$, read $(4\,b-a^2)$.
716	2	11	read $\dot{u}=\mathrm{A}\,a^x\dot{x}$.
717	2	6	from bottom of page, for cof. x cof. h, read ſin. x cof. h.
724	2	15	from bottom, for $2\,a\,x$, read $2\,a\,\dot{x}$.
730	2	13	for $x^3-a\,x^2+a^2x-a^3$, read $x^3-a\,x^2-a^2x+a^3$.
731	2	23	for P, read c, and line 39 for γ, read r.
732	2	2	read $\sqrt{(\dot{x}^2+\dot{y}^2)}=$.
—	—	5	from bot. read $\frac{\left(a^2c^2+4(a^2-c^2)(a\,x-x^2)\right)^{\frac{1}{2}}}{2\,a^4c}$.
733	2	7	from bottom, for $p-$, read $p=$.
734	1		laſt line for $y-$, read $y=$.
735	2	9	for § 101, read § 104.
738	1	6	for $\left(\text{tan.}=\frac{x}{\beta}\right)$, read $\left(\text{tan.}=\frac{x+\alpha}{\beta}\right)$.
739	1	12	for *the laſt*, read *the laſt but one*.
741	1	24	add } after B, ſo as to include $-\mathrm{A}(\alpha\pm\beta\sqrt{-1})+\mathrm{B}$ between brackets.
—	2	11	for B read B″.
744	2	9	for n read m, and line 21, for cof. $2=1\pi$, read cof. $2\pi=1$.
748	2	19	for $x=$, read $x^n=$.
—	—	6	from bot. in the exponent of the denominator, for $\frac{m}{n}+p+1$ read $\frac{m}{n}+\frac{p}{q}+1$.
750	1	6	for $\int x^{m-1}\dot{x}$ read $\int x^{m-1}\dot{x}$.
751	1	7	for $\int\frac{x\,\dot{x}}{\sqrt{(1-x^2)}}=$ read $\int\frac{x^3\dot{x}}{\sqrt{(1-x^2)}}=$.
753	1		laſt line, for π read $\frac{\pi}{2}$.
754	2	14	from bottom, for $\frac{1\cdot5}{4.6}$ read $\frac{1\cdot3}{4.6}$.
764	1	10	for *or*, read *for*; and line 12, for, $\frac{8\pi a^2b}{15}$ read $\frac{8\pi d^2b}{15}$.
765	1	19	from bottom, read $s=\pi\left\{\frac{(a^2-4y^2)^{\frac{3}{2}}}{6\,a}-a^3\right\}$.
—	2	20	from bottom, inſert a comma between x $\dot{z}$ and flux.
766	2	11	read $\frac{\int x\,\dot{s}}{s}$, and line 13 read $\frac{\int y^2\,x\,\dot{x}}{\int y^2\,\dot{x}}$.
—	—	11	from bottom read $\mathrm{X}=\frac{\int x\,\dot{z}}{z}=\frac{a}{z}\int(\dot{z}-\dot{y})$.
767	2	2	read $\frac{\frac{2}{3}a\,x^3-\frac{1}{4}x^4+c}{a\,x^3-\frac{1}{3}x^3+c'}$.
769	1	19	read $\dot{y}x-\dot{x}\,y=0$.
773	1	6	for *every* read *any*.
776	2	8	for $1\left\{a+x+\right.$, read $1\left\{a+y+\right.$.

DIRECTIONS FOR PLACING THE PLATES OF VOL. VIII.

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